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THE ELEMENTS OF DEDUCTIVE LOGIC

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THE
ELEMENTS
OF
DEDUCTIVE LOGIC

BY

PRABHU DUTT SHASTRI, I.E.S.,

Ph.D. (Kiel), B.Sc. (Christ Church, Oxon.), M.A., M.O.L.,
B.T. (Punjab), M.S.G. (Berlin), Dip. Theol.,
'Vidyâsâgara,' 'Shâstravâchaspati,'

*Senior Professor of Mental and Moral Philosophy,
Presidency College, Calcutta.*

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To

The Hon'ble Mr. J. A. Richey, M.A.,
Director of Public Instruction,
Punjab,

This Volume is Respectfully Dedicated
As a small token of
Gratitude and Esteem,
by
The Author.

ERRATA.

Page 19, line 12, for alter *read* order

,, 48, ,, 9, ,, Hypothetica ,,, Hypothetical

,, 48, ,, 10, ,, not P ,,, not-P

,, 50, ,, 7, ,, more much ,,, much more

,, 50, ,, 7, ,, legic ,,, logic

,, 92, ,, 3, ,, othes ,,, others

,, 95, ,, 5, ,, In ,,, It

,, 121, ,, Top ,,, Supposition ,,, Suppositio

,, 142, ,, 17, ,, hyphthalical ,,, hypothetical

,, 146, after line 29 *insert* 'form Categorical. In its use even the'

,, 160, line 25, *omit* E

,, 186, ,, 11, for Spinza *read* Spinoza

,, 216, ,, 29, ,, 41 ,,, 4·1

,, 278 ,,, 4, ,, pecial ,,, Special



PREFACE.

THIS volume has been prepared to answer the requirements of students as well as teachers. Students will find in it all that they require for an intelligent and methodical study of the subject ; and teachers will also find it a convenient handbook with hints and references to a further study of the subject. My object in preparing this text-book has been to offer, within a limited compass, a clear and consistent exposition of the fundamental principles of Deductive Logic from the ancient Traditional as well as the most modern Genetic and Pragmatic standpoints. It is regrettable that most of the graduates and M.A. students of our Universities lack in a sound knowledge of the elementary principles of Logic —a very small number comes forward to specialise in this branch—and are even ignorant of the names of some of the most famous modern exponents of logical doctrine. At the same time, teachers also speak of a dearth of such elementary text-books as combine all the

following features: (i) a brief and systematic presentation of the outlines of Traditional Logic, (ii) its relation to modern thought and criticisms, (iii) the views of the leading legislators in logical doctrine and terminology, (iv) the standpoint of the new Pragmatic Logic, and (v) the analogies between Aristotelian and Hindu Logic. It is with a view to remove this deficiency in a humble way that this book is written. As it is an *elementary* treatise, I have refrained from developing at any length my own standpoint. To facilitate the student's visualisation, I have taken special care in the systematic arrangement and methodical presentation of the subject. Complete analytical summaries are placed at the end of each chapter, hints on the method of attacking logical problems are given, a large number of typical exercises is worked out, and about 200 questions are added, most of which have been selected from the various public examination papers set at British and Indian Universities. A judicious selection of matter has necessitated the omission of all unnecessary details and facts of a purely controversial nature; but nothing important has been left out, and useful parallel references

have been added as foot-notes for the benefit of teachers and advanced students. Two notes have also been appended ; one on the History of Logic, and the other on Hindu Logic. Thus a small attempt has been made to make the book up-to-date. It has been specially designed to meet the requirements of Intermediate students of Indian Universities, although it is likely to prove useful to students of Foreign Universities as well. Junior students might, in their first reading, omit the following portions :—Pages 14-15, Bk. I. Ch. 2, pages 64-65, Bk. II. Ch. 1-2, pages 138-150, 167-170, Bk. III. Ch. 10, and pages 363-365. The Principles of Induction are treated separately in my "*Elements of Inductive Logic.*"

In writing this volume I have availed of most of the important works on the subject. My heaviest obligation is due to my esteemed teachers and friends of Oxford, *viz.*, Mr. H. W. B. Joseph, Dr. F. C. S. Schiller and Mr. F. H. Bradley, whose works, written from different standpoints, are among the most important, brilliant and authoritative contributions to logical investigation. Among other authors whose works have been particularly

useful to me are Mr. W. R. Boyce Gibson, Mr. Alfred Sidgwick, Professor Bosanquet, Professor Welton, Professor Carveth Read, Father Joyce, Dr. Keynes, Mr. St. George Stock, Mr. J. L. O. Croke and Dr. Coffey.

I am also indebted to Professor Krishna Chandra Bhattacharya, M.A., of Bethune College, for his courtesy in reading the proofs of a part of this book and making several valuable suggestions and criticisms.

Any suggestions and critical observations which teachers and others interested in the subject may like to make will be gratefully acknowledged.

PRABHU DUTT SHASTRI.

PRESIDENCY COLLEGE,

CALCUTTA,

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THE ELEMENTS OF DEDUCTIVE LOGIC

INTRODUCTORY

CHAPTER I.

DEFINITION, FUNCTION AND SCOPE OF LOGIC.

1. **Definition and Subject-matter.**—It is customary to begin a scientific treatise with a definition of the science, although the proper place for definition is at the end. But our preliminary definition may be useful if it is not taken for more than a general statement of the aim or purpose of the book. If, however, its subject-matter is concerned with objects of the external world, objects that we can perceive by the senses, the definition at the outset can easily be understood in so far as it may arouse curiosity and human interest. But the subject-matter of Logic is too abstract to awaken any such interest. We are required to traverse familiar ground in an unfamiliar way. [Although some old books on Logic contain several puzzles, tricks, fallacies and repartees that are amusing and naturally appeal to students as very interesting intellectual games; yet that is not the proper way to awaken logical interest; their treatment has only a subordinate significance in a true scheme of logical doctrines. Logic is the most abstract of our sciences, and is concerned with the inner

world of thought *par excellence*: its object is thought itself. Logical consciousness arises with the reflective activity of thought. In other sciences, our thought studies facts and relations, but in Logic our thought studies itself. We do not study its manner of occurrence, the way in which it arises and develops—that is the province of Psychology; in Logic we are only concerned with the validity of the thought. In other words, Logic is not concerned with the actual processes of thinking and reasoning, but rather with their products: it is not interested in the analysis of the process of thought by which we argue but in the argument itself. As human knowledge, under the conditions in which it exists, cannot be complete or perfect, there are always risks of error in our reasoning. We are not born with a ready-made knowledge of all reality in our mind, but each one of us has to gradually discover knowledge and thus to construct his own world ideally. In so doing we are liable to err occasionally. Error is not only possible, but under human limitations it is a psychological fact. It was this liability to error that first brought Logic into existence. The aim of Kanada, the father of Hindu logic, and Aristotle, the father of Western logic, was no other than to study the difference between good and bad reasoning. The ways of reasoning badly are infinite, but the principles of valid reasoning can be laid down with precision and certainty; hence Logic is not directly concerned with fallacies and other modes of false reasoning but proposes to lay down the most general principles of correct thinking.

Our thought must conform to such general principles in order to be valid.

Logic has been called the *Science of Sciences*, since all sciences must recognise and conform to its general principles which are the very foundation of all thinking, the very life-blood for the growth of all knowledge. In India too Logic has always been looked upon as the most general propædeutic, the most useful intellectual discipline which should precede a study of the higher metaphysical schools of philosophy. According to the ancient methods of teaching, for instance, a student was not allowed to take up the *Vedânta* or the *Sâṅkhya* until he had a previous training in the *Nyâya* system. "Within every special science, whether worked out by itself or not lies a method, and hence a fragment of Logic" (Windelband).

Inasmuch as Logic proposes to inform us as to the nature of true thinking, it may also be defined as the *Science of Truth*. But on the problem of the nature of Truth there has always been—and particularly during the last ~~decade~~ ^{ten years}—a keen controversy. Keeping aside the question whether truth consists in an agreement of our ideas with the external things or in the conformity of things to our mind, which was ably and scientifically discussed by Kant, the problem that has engaged recent thought in Europe and America is to determine whether there is any such thing as 'Absolute Truth' beyond 'Provisional Truths,' which are true because they work and which possess value only in so far as they are useful for human purposes. The Absolutists maintain the

existence of an Absolute Truth which is independent of human needs and purposes ; while the Pragmatists hold truths to be relative to the human will. This is not a place to discuss this metaphysical problem, but we may only state our position at once by saying that while we recognise the elements of truth in Pragmatism, particularly its value as a method of synthesis and reconciliation, we are not prepared to reject the idea of the Absolute. While our truths, which may be the various forms in which the Absolute Truth appears to us, may vary and change, there runs throughout these changing forms an abiding element without which they will not exist and cohere in a system of truths. "Truth is one and indivisible," says Ritchie,* "in the sense that the universe is one system ; but in the one system there may be many subordinate systems, each of which is a cosmos or world, though not *the* universe ; and in the one system, and in each of such subordinate systems there are many aspects, and as we know partially and incompletely, we are led to speak of there being more than one kind of truth." We have said above that so far as our knowledge of reality is concerned, each one of us constructs his own mental world, and interprets reality according to the light of his own knowledge. From this standpoint of relativism and individualism it is impossible that any two of us may have exactly the same world of experience. Yet if we eliminate human limitations and view reality as a whole, we must be driven to hold that although minds may be

* D. G. Ritchie, *Philosophical Studies* (Macmillan, 1905), p. 73

many, yet reality is ultimately one and it manifests itself partially to each individual relatively to his insight and knowledge. The individual mental constructions of reality are in Dr. Bosanquet's words, "drawings in perspective of the same building from different points of view. Our separate worlds may be compared to such drawings: the things in them are identified by their relations and functions, so that we can understand each other, i.e., make identical references, though my drawing be taken from the east, and yours from the west. The things do not look quite the same in our different worlds; besides being taken from different standpoints, both drawings are imperfect and incorrect. . . Logic shows us the principles and processes by which, under the given influences, these drawings are constructed."* Thus our common knowledge represents the totality of individual knowledges in its essentials. If it were possible for us to have intuitive knowledge of the whole of reality, to view the universe (*sub specie æternitatis*), our knowledge would be perfect, no partial truths would be necessary, and no error would exist. But the actual conditions are otherwise; hence arises the importance of Logic.

Thus Logic treats of the principles of right thinking, and such treatment has always a reference to truth. The distinction between *formal* and *real* treatment of Logic is at best a distinction within a unity; in the former we emphasise the validity of our thinking, and in the latter we are mainly interested in the adjustment

* Bosanquet, *Essentials of Logic*, Macmillan, 1895, pp. 18-19.

6 DEFINITION, FUNCTION AND SCOPE OF LOGIC. [INTROD.]

of our thought to the objective reality. Right thinking, therefore, includes both consistency and truth. The following are some of the current definitions of Logic* :—

- (1) Logic is the science of right thinking.
- (2) Logic is the science of the laws of valid thought.
- (3) Logic is the science of the regulative principles of human knowledge.
- (4) Logic is the science of the laws of thought as thought (i.e., it is concerned with the *form* of thought, to the exclusion of the *matter*).
- (5) Logic is the science of proof rather than of discovery.
- (6) Logic is the art of thinking (which mean of correct thinking), and the science of the conditions on which valid thinking depends ; thinking being valid when it not only is free from inconsistency or self-contradiction but also leads to true results.

Very recently a new type of Logic has arisen in revolt against *Formal Logic*. It is called *Instrumental Logic* and is based on the pragmatic theory of thought being purposive and an instrument of action. Thus, according to Prof. Dewey, Logic is concerned with the problem of the relation of thought as such to reality as such. So also Dr. F. C. S. Schiller, the vigorous

* Also note the definitions proposed by (1) Kant : Logic inquires into the laws of our thought—how we ought to think, “wie wir denken sollen”, (2) Sigwart: “Kunstlehre des Denkens, welche die Kriterien des wahren Denkens feststellen soll.”

champion of "Humanism" constructs Logic on a psychological foundation, and as all truth is relative, Logic also must be relative to human needs.*

2. **Function.**—In Europe Aristotle was the founder of Logic and had a *practical* aim in view. He thought that a study of Logic should teach men to argue correctly to enable them thereby to better enjoy the intellectual game of disputation. The old Greeks, like the Indians, used to find the keenest enjoyment in argumentation. Aristotle invented the syllogism to teach the Athenians how to test the consistency of an argument, and how to discriminate between a valid and an invalid argument. The same was conceived to be the object of Logic—*Tarka-Shāstra*—by Kanada and Gautama, who founded this science in India before Aristotle was born. They held that one of the objects of Logic was to teach us how to reason correctly and to distinguish between a correct argument—*tarka*—and an incorrect one, a fallacy—*tarkābhāsa*, *heterābhāsa* or *nyāyābhāsa*.

Aristotle's Formal Logic, also called Traditional Logic, retained its influence and power for many centuries, and all along men believed that Logic was concerned simply with the forms of pure thought, regardless of the particular things thought of; so that if we find that

$$\begin{array}{c} M \text{ is } P \\ \text{and } S \text{ is } M \end{array}$$

* For an exhaustive criticism of Formal Logic, read Schiller's *Formal Logic*, Macmillan, 1915.

we can be quite sure of the conclusion, *viz.*, S is P whatever S, M, and P may be. We are not concerned with the truth of the first two statements, but if they are accepted as true, the conclusion must follow. The conclusion may or may not be true *in fact*, but it is *formally valid*.

But after the Middle Ages, with the emergence of a fresh and new conception of the purport of Philosophy, the accuracy of this conception of Logic also began to be questioned. Bacon was the first to raise his voice of protest against it. In fact Roger Bacon (1214—1294) was the founder of what is now known as Inductive Logic, and it was later on improved by Francis Bacon (1561—1626) and systematised in the 19th century by J. S. Mill (1806—1873). With the close of the Middle Ages the defects of Traditional Logic began to be felt, and it was realised that Logic was quite helpless against many errors to which men are liable in the investigation of cause and effect. “Bring your thoughts into harmony with authority” was the mandate of the Middle Ages, and “Bring them into harmony with fact” was the requirement of the modern times.* Traditional Logic was found powerless before the vast complexity of facts. It was felt necessary to find out not only if S is P was consistent as a mere conclusion from the two statements M is P and S is M, but also if it was true *in fact* and whether those statements themselves were true in the form in which they stood. In other words, Logic began to be considered as a science

* Die Grundaussetzung der Logik ist der Wille zur Wahrheit.

of *real* thought, as a science of *truth*, of the agreement of thought with actual things, and not merely as a science of *pure* or empty thought. It was held that thought could not be studied apart from things, that *form* could not be studied apart from *matter*. Thus arose Material (usually identified with Inductive) Logic as distinguished from Formal (usually identified with Deductive) Logic. The latter is also called the logic of consistency and the former the logic of science. As we have already observed, the former aims at validity, the latter at truth. Both, however, refer to a distinction within a unity. A formal and a real logical treatment "equally imply a fundamental respect for consistency, and they both involve a reference to reality, though the reference is occasional in one case and systematic in the other."* The relation of Deduction and Induction will be explained afterwards. Here we may only add, in the words of Minto, that "there is no antagonism whatever between the two branches of Logic. They are directed to different ends. The one is supplementary to the other. The one cannot supersede the other." *without* ; i.e.

Thus the function of Logic is conceived differently by the upholders of Formal Logic and those of Material Logic. Let us try to reconcile the two points of view. It is doubtless true that thought is always thought about something, and Logic cannot study

* Boyce Gibson's *Problem of Logic* (A. & C. Black, London 1908), p. 7. He takes Formal, Real and Philosophical as three main stages in the life of Logic.

thought without some subject thought of. But, as Mr. Joseph cogently remarks :—“ Yet in the same way that we may study the laws of motion as they are exemplified in the movement of all bodies, without studying all the bodies that ever move, so we may study the laws of thought, as they are exemplified in thinking about all subjects, without studying all the subjects that are ever thought of.”* The science of Logic would be an impossibility if it aimed at studying *all* the subjects we think of. They form the provinces of different sciences, and Logic is at the very basis of all of them but it cannot usurp their function.

Again, Logic treats of the *products* of thought and not of the *processes* of thought—the latter is the province of Psychology. And mental products, concepts, judgments and reasoning, cannot be so treated unless they are expressed by means of language. From this point of view, Logic has also been regarded as conversant about language, as the science of the use of names, propositions and arguments. Thus for a complete theory of truth we have to consider Thoughts, Things and Language. But Logic deals primarily or directly with thoughts, and secondarily or indirectly with the subject of thought as well as with language—the vehicle of expression.

The study of Logic is helpful to us in so far as (1) it furnishes us with a negative criterion of truth by which we can detect error, and (2) defines the positive principles of right thinking. Its general practical value lies

* H. W. B. Joseph's *Introduction to Logic*, Oxford, 1906, p. 2.

in its creating a habit of close scrutiny and careful thinking, of better understanding the meaning of the expressions we use and in enabling us to test the truth and validity of our own opinions as well as of others.

But it must not be supposed that no correct thinking is possible without a study of Logic. In everyday life we meet with people most of whom never studied Logic and yet argue correctly. In fact practice always precedes theory. The rules of Grammar were made after men had been able to speak correctly, the science of medicine came into being after people had led healthy lives, the law of gravitation was discovered after several bodies had been observed to fall on the ground, the theory of swimming was framed after people had been actually able to swim, and so on. Similarly it was quite possible for men to reason correctly before Aristotle laid down the rules of the syllogism. It might then be asked, if so, why do we study Logic at all? If everyone is a logician in some way or other, why waste time on this abstract science? The answer is easy enough. Those who can and do reason correctly without a study of Logic are, as a rule, unable to realise the principles governing their right thinking: they are like a blind artist working with his tools, they possess only an empirical knowledge, they may be able to detect the errors of other people's reasoning, yet they are unable to explain the grounds of error. Thus, they might unconsciously reason correctly, but they do not possess that *insight* which systematic study alone can give. By a study of Logic, therefore, they have nothing to

lose, but much to gain. A man who has reflected upon the principles of reasoning is much less likely to be deceived than one who is guided unconsciously by assumptions which he has never examined. None would say that medicine is useless because men are healthy without it.

Apart from that, the study of Logic is greatly useful as a mental discipline. We take to the study of several subjects with the object of training our intellect, and no subject is so useful for that purpose as Logic.

3. **Scope.**—The general scope of Logic should be evident from the foregoing remarks under "Definition." It will, however, be more clearly defined if we distinguish Logic from other sciences more or less akin to it.

Logic is to be distinguished from Psychology as follows:—

PSYCHOLOGY.	LOGIC.
<ol style="list-style-type: none"> 1. Investigates the <i>process</i> of Thought. 2. Discusses how Thoughts are arrived at. 3. Its object is to analyse mental activity. 4. Teaches how people actually think. 5. A descriptive science. 6. Deals with personal thought, i.e., thought as part of the life process of individuals. 	<ol style="list-style-type: none"> 1. Investigates the <i>products</i> of Thought. 2. Discusses Thoughts themselves their validity or invalidity. 3. Its object is to lay down principles to which all right thinking must conform. 4. Teaches how people <i>should</i> think if they want to think rightly. 5. A normative science. 6. Deals with thought in a detached and impersonal way. <p style="text-align: right;">✓ ✓ ✓ ✓ ✓ ✓</p>

Logic may also be distinguished from Grammar as follows :—

GRAMMAR.

1. Directly concerned with language.
2. Indirectly concerned with meanings.
3. Primarily deals with the relations of words.

LOGIC.

1. Directly concerned with meanings only.
2. Treats of Language indirectly—only as a vehicle of thought.
3. Deals with relations of words secondarily, only so far as they affect the meaning.

4. Logic, a Science or an Art.—Duns Scotus, a British logician of the 13th century, spoke of Logic not only as the "Science of Sciences" but also as the "Art of Arts." Now, let us see in what sense Logic can be called an *Art*.

(The general distinction between Science and Art is that between *knowing* and *doing*.) All knowledge is not science, only systematised knowledge can be so called; similarly art is systematised action. Science is acquired by study, while art by practice. Science gives us insight, while art gives us skill. According to Aristotle, science is conversant with *that which is*, and art with *production*. The word "art" is, however, used in two senses, viz., (1) practical skill in doing and (2) theoretical knowledge of doing (in this sense art is necessarily based on science). Logic has already been defined by us as a science, but it may also be called an art in the

latter sense. As in this sense an art presupposes a science, it is obvious that there must be a science of Logic if there is to be an art of Logic. As Logic gives us 'principles'—and not mere 'rules'—of right thinking, it is primarily a science; but when we master its principles we can generally display our practical skill in avoiding incorrect thoughts. Thus indirectly, Logic is an *art* of thinking, though it is pre-eminently a *science*. Mr. Joseph rightly observes: "It is perhaps from a desire to show the practical value of the study of Logic that men have insisted on viewing it as an art. But it would be a mistake to suppose that its practical value can lie solely in its furnishing rules for 'the conduct of the understanding.' The direct help that it can give in this way is not very great." (*op. cit.* p. 10).

5. Logic distinguished from Science.—We have spoken of Logic as a *science*. But we must strictly speaking distinguish logical consciousness from scientific consciousness in order to bring out the peculiarity of the former. If we hold that the object of thought, *viz.*, the thing, is not to be identified with thought itself; in other words, if we allow the common distinction between the thing and thought to stand, we can distinguish Logic as a study of thinking from Science as a study of things or objects. The same fact may be stated in a more general form by saying that *science* is concerned with the object apprehended, and *logic* with the apprehension itself. Science is indeed a way of apprehending objects and logic is a reflection upon such apprehension in general.

The distinction is not affected by the theory as to what constitutes the reality of the object—that is for metaphysics to discuss. This distinction is of great importance, for scientific thinking is essentially different from logical thinking. When we speak of logic as a science we mean by science nothing more than a methodological study in general; but at the same time we want to guard against the misconception that logical thinking is identical with scientific thinking. Such a misconception is bound to obscure some of the vital distinctions in the field of knowledge. Logic is concerned essentially with the subjective side of thinking, science with the objective side. As our knowledge advances, the subjective side of thinking becomes itself later on the object of consciousness, that is a new kind of thinking which we may call reflex, as opposed to scientific thinking. This advanced thinking, *viz.*, reflective thinking, leads to the abstraction of thinking as such, as our own subjective activity. It is the discovery of these abstract forms of thinking which constitutes the beginning of logical inquiry.

SUMMARY.

Logic is the science of the forms of right thinking. It is a normative science and teaches us how we ought to think if we want to think correctly. Kanada and Gautama were the Founders of Indian Logic, while Aristotle was the Founder of Logic in the West. Logic is primarily concerned with Thought, and only

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secondarily with Things so far as Thought must be about *something*, and with Language so far as it is the vehicle of thought.

Logic cannot be dismissed as useless on the ground that men can reason without its aid, any more than medicine can be considered useless because men are healthy without it. It furnishes us with insight into its principles, by which we can detect and avoid error. It also trains our intellect and forms in us the habit of careful thinking.

Logic is to be distinguished from Psychology and Grammar.

Logic is primarily a *science*. It is an *art* in a restricted sense, in which it is presupposed as a *science*.

Logic, when distinguished from science, is defined as a study of thinking, science being a study of things.

CHAPTER II.

THE LAWS OF THOUGHT.

1. **Character of the Laws.**—We have spoken above of the laws of right thinking. What are these laws. On analysing knowledge we find that in order to be systematic it must conform to certain laws. These Laws of Thought with which Logic is concerned are such as we *ought* to observe if we are to think rightly ; not necessarily those that we *do* actually observe. We can break them by thinking incorrectly as we can break the laws of conduct by doing what is wrong. The discussion of the genesis of the Laws of Thought falls outside our scope, since that belongs to Psychology. Logic assumes them to be *a priori*, i.e., they are not derived from experience but they are conditions of all experience. They make experience possible. They are, at the same time, *necessary* so far as right thinking is concerned ; none would, as a rule, violate them consciously. They are also *formal*, since they are involved in all thinking and cannot by themselves give any knowledge of particular things.

They are also known as the Postulates of Knowledge or as the Axioms of Dialectic and of Syllogism or as the Maxims of Consistency. They are assumptions without which knowledge is impossible. Every science starts with certain assumptions that it accepts as true without inquiring into their justification—a task reserved for Metaphysics, “ the science of *first principles*. ” Thus Logic too, like other sciences, assumes the truth

of these Postulates or Laws or Principles of Thought. It assumes them because it finds them already assumed in every valid or coherent thought. They are variously enunciated and variously described but all the same they are held to be the foundation of all Logic.

Formal Logic recognises only *three* laws as the Primary Laws of Thought, viz., (1) The Law of Identity, (2) The Law of Contradiction, (3) The Law of Excluded Middle.

2. The Law of Identity.—

Statement :—‘A is A.’ ‘Whatever is, is.’
‘Everything is what it is.’

It means that the meaning of terms we use in any argument must be fixed. It sounds extremely simple and one wonders if any explanation of such an obvious truth is necessary. Mill states it thus: “Whatever is true in one form of words is true in every other form of words which conveys the same meaning.”*

Now let us take the statement: ‘Iron is iron.’ It is in the form of ‘A is A.’ There is no difficulty in assenting to it, but it hardly conveys any information. It is in fact tautologous. If we say ‘Iron is horse,’ it is in the form of ‘A is B.’ Here there is nothing in common between A and B, hence the statement is false. The first was a tautology, the second is false. Now, therefore, in order not to be either tautologous or false,

* But Mill’s view of identity of mere verbal meaning is rejected by us, as will appear from the following paragraph.

our thought must pass beyond the bare identity of an object with itself—since to keep within the self-identity of an object is to arrest thought—but at the same time it must not pass to something which has nothing in common with the object. For instance, when we say 'Iron is hard, Iron is heavy, Iron is useful'—we are leaving behind the self-identity of 'Iron' and are passing on to its relations of likeness. Thinking is impossible without entering into such relations of agreement with other objects. We cannot know identity except through difference. Hegel acutely remarked: "A thing must other itself in ~~order~~^{order} to be itself."* A tree grows imperceptibly, its growth can be marked if you do not look at it daily. After a few months is it the same tree or has it changed? It is identical with what it was some months ago, yet it is changed. (The child grows into the man. The very fact that he is known by the same name throughout shows that he is the same person. Yet he is changed. Horses differ from one another in several respects, yet they all share the common characteristics of a horse. Thus for our knowledge identity really means likeness amidst unlikeness, similarity or uniformity amidst diversity. When, therefore, we say 'A is A' we mean that a thing remains what it is even amidst change; in other words, a thing has a *definito* nature.

* The true unit of thought is the judgment, which, as Hegel says, asserts an identity in difference or difference in identity. This formula protests against the delusion of Formal Logicians that bare identities and bare differences are of use in our thinking.

3. The Law of Contradiction.—

Statement : ‘A cannot be both B and not-B.’

‘Nothing can both be and not be.’

‘What is contradictory is unthinkable.’ Hamilton prefers to call it the Law of Non-Contradiction, since it enjoins the absence of contradiction as the indispensable condition of thought. This principle denies that a thing can, at the same time, both have and not have the same attribute. In the same sense and at the same time a statement cannot be both true and untrue. The same milk cannot, at the same time, be white and not-white. I cannot both be tall and not-tall, wise and not-wise, good and not-good at the same time. Now I may be wise, at another time I may be not-wise ; these are compatible, but *at the same time*, under the same conditions, I cannot be wise and not-wise. A thing may now be hot and again cold : there is no contradiction here. But the same thing cannot, at the same time, possess contradictory attributes. According to this Law we cannot deny in the same sense and at the same time what we have once affirmed of a subject. In other words, the Law expresses the fact that truth is free from contradiction.

4. The Law of Excluded Middle—

Statement : ‘A is either B or not-B.’

Mill rightly says that this Law is the complement of the doctrine of contradiction. By the Law of Contradiction a statement cannot be both true and false ; by that of Excluded Middle it must be either true or false—there is no third possibility. It must be clearly

understood that we are now concerned with *contradiction* and not with *contrariety*. No third alternative is possible between two contradictory terms, while many alternatives are possible in the case of contrariety. For instance, the relation between white and not-white, hot and not-hot, sweet and not-sweet, is that of contradiction : A thing must either be white or not-white, black, blue, yellow, grey, etc., all coming under 'not-white'; so also a thing may be sweet or not-sweet ; no intermediate stage is possible in this case. But the relation of contrariety is different : e.g., a thing may neither be white nor black—'white' and 'black' being 'contrary' terms. It may be blue or yellow or green or red : in any case it is neither white nor black. Thus in contrariety several intermediate stages are possible. Contradiction is simple negation and excludes the possibility of any intermediate stage. Each one of us can say : the universe = myself + not-myself. Thus between two contradictory terms no third term is possible. The Law of Excluded Middle tells us that in all cases any given predicate belongs or does not belong to any given subject. In other words, we are told that everything is related, positively or negatively, to everything else.

Each of these Laws implies and is related to the others, and cannot, therefore, be treated in complete isolation. These principles are the very foundation of all true thinking and represent *aspects* of Truth. Whatever violates these axioms is unthinkable.

To these Principles a fourth is sometimes added called the Principle of sufficient Reason, which is

thus formulated by Leibniz :—“ Whatever exists or is true must have a sufficient reason why the thing or proposition should be as it is and not otherwise.”

5. Division of Logic.—The two main divisions of Logic are Deduction and Induction. Deductive Logic treats of deductive inference, *viz.*, the drawing of a particular conclusion from a more general statement ; while Inductive Logic deals with inductive inference, *viz.*, the drawing of a general conclusion from particular statements. In the former we proceed with more general truths and arrive at conclusions less general. It is thus the logic of *Consistency*, which generally tests the truth of a general statement by reference to its application to more particular ones. Consistency is such a relation between two judgments as makes the truth or falsity of one dependent on the other. Inductive Logic is, on the other hand, called the logic of *Science*, since it deals with the correspondence between thought and matters-of-fact, and since the progress of science is based on the discovery of universal truths through particular truths derived from experience. Thus the distinction between Deductive and Inductive Logic is based not only on the different forms of inference but also on the different aims of thought, *viz.*, consistency and knowledge of fact.

Deductive Logic is generally identified with Formal Logic. It is not directly concerned with the real truth or falsity of its data but with their formal consistency. The function of Inductive Logic is, however, the attainment of truth.

6. **Parts of Deductive Logic.**—We shall stick to the usual division of Deduction and Induction and shall first deal with the former, which is usually divided into three parts, Terms, Propositions and Inference. These are the expressions of the three products of thought, viz., Concepts, Judgments and Reasons. This trichotomy is based on the assumption that three different moments can be distinguished in every single act of thought—which in its true nature is unique and unanalysable. Prof. Croce is right when he says :—“ As a matter of fact, no one will ever succeed in thinking a concept, a real concept, which is not at the same time a judgment, i.e., an assertion of its own essence ; nor can any one find a concept or a judgment which is not at the same time a conclusion, being connected in a system with other conceptions and judgments.”*

The *Term* is a name affixed to an object by a comparison of attributes, e.g., book, chair, man, etc.

The *Proposition* is the unit of thought and contains two terms, e.g., This book is heavy ; This chair is light.

Inference is a comparison of propositions, e.g.,

All men are rational animals.

Plato is a man.

∴ Plato is a rational animal.

* Croce's article in *Encyclopaedia of the Philosophical Sciences*, Vol. I, Logic (Macmillan), p. 202.

SUMMARY.

<i>Law of Identity.</i>	<i>Law of Contradiction.</i>	<i>Law of Excluded Middle.</i>
1. 'A is A'	1. 'No A is not-A' or 'A cannot be both B and not-B.'	1. 'A is either B or not-B.'
2. Everything is what it is.	2. Nothing can both be and not be.	2. Everything must either be or not be.
3. It means that everything has its own characteristics.	3. It means that we cannot deny what we affirm at the same time.	3. It means that a given Predicate. does or does not belong to any given subject.
4. Implies that things have a definite nature.	4. Implies that true statements cannot conflict.	4. Implies that every thing is related to everything else.
5. The use of a term asserts all the attributes it implies.	5. The use of a term denies all other attributes incompatible with those implied.	5. Everything must either possess all those attributes or be without some, or all, of them.

Note :—The last-named distinction is from the standpoint of language.

BOOK I.

TERMS.

CHAPTER I.

KINDS OF TERMS.

1. The Unit of Thought.—It is customary to begin a treatise on Logic with Terms, and we do not intend to depart from the usual course. But at the same time the student must understand that the Term does not stand for a complete act of thought. The unit of thought is the *Judgment* or *Proposition*.* Logic should really begin with a discussion of Judgment, and some of our modern writers have actually carried out this idea. In fact, Logic can be nothing but a *doctrine of judgments*: since Terms are abstracted from judgments, and inference too is only one way of establishing judgments or it is a judgment by means of judgments. But as Terms are the elements of a Judgment we usually begin with a study of these elements. By themselves and apart from their position in a judgment terms cannot be properly understood. They have meaning only in relation to their position and function in a proposition; by themselves they are 'abstractions.' But

* The Proposition is the verbal expression of a Judgment. Judgment—“Proposition as understood.”

this does not mean that we are logically precluded from discussing them separately. "A term is, in fact, just a potential subject or predicate, so that even in abstraction from the proposition it still remains intrinsically related to it. Though it need not be doing actual service within a proposition, it must at least belong to the reserve."* For purposes of scientific study we usually have to abstract in thought what cannot be separated in reality. In psychology, e.g., we analyse an act of perception into its elements and study them separately, although an actual perception is a fact unique by itself. If we only keep in mind that terms are derivatives from the proposition, which alone is the true logical unit, it may appear quite convenient to take up the study of Terms before that of Propositions.

2. **Definition of the Term.**—Logically considered a Proposition consists of three parts: † (1) the *Subject*, that of which the assertion is made, (2) the *Predicate*, what is affirmed or denied of the Subject, and (3) the *Copula*, the verb *is* (either alone or joined with *not*) which expresses relation between the subject and the predicate. Thus we have—

"Man is mortal"

Subject Copula Predicate

Now, the Subject and the Predicate, i.e., the parts into which a judgment is analysed, are called **TERMS** (from Latin *terminus*, boundary or end). A TERM may, there

* Boyce Gibson, *op. cit.*, p. 111.

† This is the ordinary way of expression. For a detailed and critical statement see Book II, Ch. 2 *infra*.

fore, be defined as "whatever can be thought as the subject or predicate of a proposition."* A Term is always an object of thought but not necessarily an object that actually exists or could exist.

3. Terms distinguished from Words and Names.—

Terms should first be distinguished from Words. All *terms* are *words*, but not all *words* are *terms*. Those words, e.g., articles, adverbs, prepositions, conjunctions and interjections, which do not stand independently for an object of thought are not terms. Again, more than one word may constitute a term, since the subject and the predicate are not always expressed each in a single word. Thus a proposition may contain several words but there cannot be more than two terms in a judgment.

Terms are also to be distinguished from Names. "A Name," says Hobbes, "is a word taken at pleasure to serve for a mark, which may raise in our minds a thought like to some thought we had before, and which, being pronounced to others, may be a sign to them of what thought the speaker had, or had not, before his mind."† A *Name* is the expression of our thought,

* To this definition Mr. Joseph adds a very significant note : "Nothing is a term except when it is so thought ; but when we consider terms in isolation, the question is not whether anything is a term in a given judgment—for there is no judgment given—but whether it is a term of a possible judgment "(op. cit., page 16 note). This is an important consideration, esp. for the Pragmatist when he disposes of Terms as *mere fictions* to which *no real act of thought corresponds*.

† Cf. Hobbes' *Computation, or Logic*, Ch. II.

considered out of all relation to its position in a proposition, while a *Term* is one of the elements into which we break up a proposition. Thought is not made up of *names*, which belong only to the expression of thought in language. But by common usage the word "term" has now come to imply both the object of our thought and its expression in language.

4. **Distinction in Terms and in their Use.**—Terms are distinguished in themselves and in their use. As to their *use* we distinguish them as—

(1) *Categorematic* and *Syncategorematic*: Those words that can by themselves be used as terms, i.e., as subject or predicate in thought, are called *Categorematic*; while those words which can only be used as terms in conjunction with other words are known as *Syncategorematic*. Substantives, Pronouns, Adjectives and Participles are *Categorematic*, while Articles, Adverbs, Prepositions, Conjunctions and Interjections are *Syncategorematic*. The use of such technical terms, however, seems rather an encumbrance of Formal Logic.

(2) *Univocal*, *Equivocal* and *Analogous*: Terms which have always one and the same meaning are called *Univocal*, (i.e., 'book,' 'boat,') while terms with more than one meaning are known as *Equivocal* (or *Ambiguous*, e.g., 'bark'). *Analogous* terms also have more than one meaning, but the meanings are more or less analogous or identical, e.g., 'thing,' 'foot.'

The following are the principal distinctions in Terms:—

- ✓(i) *Concrete* and *Abstract*
- ✓(ii) *Singular* and *General*

- (iii) *Relative and Absolute*
- ✓ (iv) *Positive, Negative and Privative*
- ✓ (v) *Connotative and Non-Connotative.*

5. **Concrete and Abstract Terms.**—This distinction is based on that between the thing and its qualities. A **Concrete term** is the name of a substance (*i.e.* a person or thing), *e.g.*, a man, a white horse, a sweet taste, etc. An **Abstract term** is the name of a quality viewed independently *e.g.*, humanity, whiteness, sweetness, virtue, sin, honesty, etc. Abstract terms are formed by abstracting in thought *one* from amongst the qualities of a thing. Whether a thing *possesses* qualities or is merely the sum-total of its qualities is a metaphysical question. The logical distinction is based on the convention of a thing having a number of qualities. An apple may be sweet, but when I think of the quality *sweetness* by itself, the word expressing it is an Abstract term.

Abstract terms are not names of qualities alone. Sometimes we abstract in thought the very substantial nature of a thing itself, and that is also expressed by Abstract terms, *e.g.*, humanity. This use is very common in Hindu Logic, where by the suffix *tram* after substantives or adjectives we form abstract terms, *e.g.*, *ghata—ghatalvam*, *laghu—laghutram*.

Obviously Abstract terms cannot be predicated of the subject, *e.g.*, we can say 'a mango is sweet' but not 'a mango is sweetness'; similarly we can say 'Aristotle is man' but not 'Aristotle is humanity.'

As abstract qualities cannot be multiplied, Abstract terms have no plural. When plural forms are used they only mean the instances in which the quality was realised. We say 'kindness' but not 'kindnesses' (unless we mean 'various acts of kindness').

Besides Concrete and Abstract terms there is another kind, called **Attributive** covering all adjectives and adjectival terms, e.g., white, green, starved, etc. They are not the names of qualities as such like whiteness, greenness, starvation, yet without implying those qualities they are meaningless. According to Mill, all such terms are to be classed under **Concrete** because, as he argues, white is predicated of snow, milk, or linen, and not of their colour. But this is not sound, since, to quote Mr. Joseph, "the subjects of which an adjective may be predicated can as well be abstract as concrete." "If their form were to be ignored, and they were to be referred either to concrete or to abstract, they should rather be considered abstract than (as J. S. Mill would have it) concrete; for their invention implies the consideration of some quality or character in the thing in abstraction from the rest of the thing's nature."*

6. **Singular and General Terms.**—This is, in fact, a further division of *concrete* terms. A **Singular** (or **Individual**) term is one which can be applied in the same sense to only one thing, e.g., Calcutta, Lahore, the King of Italy, etc. A **General** (or **Common**) term is one which can be applied in the same sense to an

* *op. cit.*, p. 26.

indefinite number of things, e.g., 'table,' 'chair,' 'king,' etc.

All Proper Names are *Singular* terms, though all *Singular* terms are not necessarily Proper Names. Thus 'the Pope' and 'the President' are *Singular* terms but not Proper names. 'Pius X' and 'Pion-care' are Proper Names.

General terms are formed by abstracting and unifying in thought all the common qualities in which individuals agree. It is not necessary that a General term should *actually* be applicable to a plurality of objects; it should only be *capable* of such application. Singular terms are not even *capable* of being applied to more than one object. All *attributive* terms are *general*.

Singular terms are sometimes distinguished from Collective terms—names applicable to a group of similar units. Thus 'library' is a collection of books; 'army' is a group of soldiers. 'class' is a group of students, etc. Collective terms may be either singular or general: that depends on our own point of view in using them.

7. Relative and Absolute Terms.—A **Relative** term is a name given to a thing or quality considered in relation to another thing or quality. If, however, it is considered in itself, it yields an **Absolute** term. 'Husband' and 'wife,' 'father' and 'son,' 'parent' and 'child,' 'greater' and 'less'—are Relative terms. These related terms are called *Correlatives*. Broadly speaking, everything is related to every other thing in some way or other, and consequently 'absolute'

terms would not exist. But the relations contemplated by relative terms are special relations commonly recognised by us. The mere existence of a relation between two objects is not sufficient to make the names 'relative,' the names must imply such relation.

8. Positive, Negative and Privative Terms.—A **Positive** term implies the presence of a quality, e.g., man, living, present, equal, etc. A **Negative** term implies the absence of a quality, e.g., not-man, lifeless, absent, unequal, colourless, etc. A special class of *negative* terms is constituted by **Privative** terms, which imply the absence of a quality which the object might be expected to have, e.g., 'deaf, blind, empty, dumb, etc.'

Negative terms present some difficulty in Logic, and the true meaning of negation is a profoundly metaphysical question. However, one might come forward with the objection that the so-called negative term usually or always indicates more than the absence of a quality and implies the presence of an opposite quality. Formal Logic welcomes the suggestion and bids us distinguish further between negative terms which are *contraries*, merely opposed within the same general subject, like 'black' and 'white,' 'equal' and 'unequal,' and such as are true *contradictories*, like 'equal' and 'not-equal,' 'white' and 'not-white.' There can be no possible positive meaning in terms like 'not-man,' 'not-white,' etc., and these are, to use Dr. Keynes' expression, of a thoroughgoing negative character. They are called **Infinite** terms by Aristotle, as they are wholly indeterminate in their meaning. The term

'not-white' is applicable to the whole universe *minus* 'white.' This is Mill's opinion as well.

But many logicians now reject this doctrine and believe that in the term 'not-white' the reference is not, as Mill supposed, to everything in the universe except white things but to some particular part of the universe called '*the universe of discourse*.' This is, in other words, the universe of relevancy. Thus in contrasting 'white' and 'not-white' we only refer to the universe of *colour* and not to the whole universe.*

As the meaning of negative terms is very vague, we do not generally require them in our actual everyday talk. Such terms, therefore, may with justification be called 'mere logical figments.' What we generally use are *contrary* (and not *contradictory*) terms, since besides involving the *contradictory*, they involve positive elements as well. Thus 'black' is not simply 'not white' but something more positive and more definite. So too 'wise' and 'foolish,' 'strong' and 'weak,' 'right' and 'left,' 'happy' and 'miserable,' are pairs of contraries, while contradiction is expressed by prefixing *not-* or *non-* to the term.

9. Connotative and Non-Connotative Terms.—A **Connotative** term is one which denotes a subject and implies an attribute, while a **Non-Connotative** term denotes a subject only or an attribute only. In other words, a connotative term has two meanings: one implying the objects to which it is applicable, which may be called its *direct meaning*, and the other implying its

* See A. Sidgwick's *Elementary Logic*, Cambridge, 1914, p. 105.

essential attributes, called its *indirect* meaning. Thus the term 'horse' is connotative, because it implies directly all the animals called by that name and indirectly the essential qualities possessed in common by all 'horses.' Similarly the terms 'man,' 'animal,' 'tree,' 'table,' 'dog,' 'cat,' etc., are all connotative. The direct meaning of such terms is called the **Denotation** or **Extension**, and the *indirect* is called the **Connotation** or **Intension**. The words **Denotation** and **Connotation** came into favour since the publication of Mill's *Logic*. But the words are not much of an improvement on the terms *Extension* and *Intension*. There is something to be said on both sides. Mill's phraseology has the advantage in the existence of the corresponding verbs 'to *denote*' and 'to *connote*', while the terms **Extension** and **Intension** are very expressive, the former expressing the range, breadth or compass over which the application of a term extends; the latter suggesting what we intend or mean by a term, in other words its depth or implication.

All concrete general terms (e.g., 'man,' 'dog,' 'canal,' etc.) and all significant singular terms (e.g., 'the sky,' 'the earth,' 'the Emperor of Japan,' etc.) are **Connotative**. Besides, abstract terms are sometimes distinguished as (a) **General Abstract Terms**,* which are

* Strictly speaking, Abstract Terms cannot be General, but the distinction referred to here is only possible when the distinctions arising in our thought about things are carried by analogy into our thought about attributes. *Vide Coffey, Science of Logic, Longmans, 1912, vol. I, p. 62.*

Connotative, and (b) Singular Abstract Terms, which are Non-Connotative. Examples of the former are—‘shape,’ ‘size,’ ‘colour,’ etc.

It should be observed that *all* the attributes possessed by a thing do not enter into its connotation, but only those because of which it bears a name, and in the absence of which the name would be inapplicable. This point is, however, debatable. Some logicians maintain that *connotation* includes all the attributes, whether known or unknown, of an object (*cf.* Jevons), while others hold that it includes only those attributes that we happen to know at the present time. The discussion of this question enters into Psychology, but there is not much to support the former view. Dr. Schiller* has rightly pointed out that this doctrine can never be cleared of perplexities until logicians make up their minds as to *which of three* sets of qualities they want it to refer, and devise distinct names for each. The qualities intended may be :—

- (1) The sum-total of qualities possessed by all the objects to which the term may be applied, whether these qualities are known to us or not.
- (2) The qualities which the term suggests to our minds. These are never the whole but always more than
- (3) the qualities necessarily implied in any application of the term.

* *Op. cit.* p. 36.

The doctrine is untrue if applied to the first sense, uncertain in the second and therefore relevant only in the third.

In order to remove the perplexities, these three sets of qualities have been distinguished by Dr. Keynes* as—

- (1) "*Comprehension*," i.e., the sum-total of qualities possessed in common by the things denoted, whether such qualities are known or unknown. "All terms have comprehension, because all can be used to mean any or all of the qualities of the things they apply to."
- (2) "*Intension*" (or "subjective intension"), i.e. the qualities which the name happens to suggest to our minds. "All terms that are *understood* to have meaning have also Subjective Intension."
- (3) "*Connotation*," i.e., the qualities necessarily implied by the name, that is, the name's *definition*. "Neither *summa genera* nor Proper Names have connotation in the restricted sense, nor can they be formally defined."

Now, let us turn to *non-connotative* terms, *viz.*, terms which merely denote a thing. The question is at

* See his *Formal Logic*, also Schiller, *Formal Logic*, p. 31; Alfred Sidgwick, *Elementary Logic*, p. 100.

once raised "Are there any such terms?"* This leads us to the discussion of the meaning of Proper Names. Mill† holds that Proper Names are not connotative but denote the individuals which are called by them: they do not indicate any attributes as belonging to those individuals. He says: "A proper name is but an unmeaning mark which we connect in our minds with the idea of the object, in order that whenever this mark meets our eyes or occurs to our thoughts, we may think of that individual object." While proper names are 'mere marks,' connotative names are 'significant marks.' Again he says, "The only names of objects which connote nothing are Proper Names, and these have, strictly speaking, no signification."‡ Abstract names could have no denotation and Proper names could have no connotation.

This doctrine has been generally criticised by many logicians, who understand Mill to imply that Proper

* All terms are *connotative* except (a) Proper Names and (b) Abstract Terms—about which there is room for doubt. We have already referred to the view which makes General Abstract Terms *connotative* and Singular Abstract Terms *non-connotative*. The general view is that Abstract Terms refer directly to 'attributes', thus they have implication, content or meaning, and therefore they are *connotative*. Proper names are *non-connotative*.

† Mill considers to be non-connotative, (1) Proper Names, (2) Abstract terms, if they are names of a logically undivided attribute.

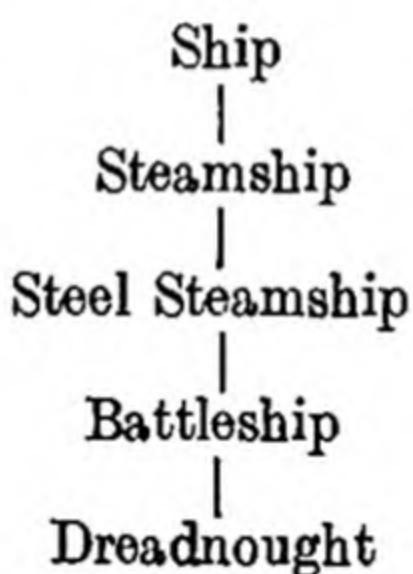
‡ Cf. Bosanquet, *op-cit* p. 91, Venn, *Symbolic Logic*, p. 183, Bradley *Principles of Logic*, p. 156, Joseph *op-cit*, p. 138.

names have no *meaning* because they have no *connotation*. But Mill could hardly be supposed to mean that, and to denounce him on this supposition is therefore not very fair. Proper names are not meaningless : this no doubt is true. As Dr. Schiller rightly observes " Mill's doctrine was right enough as regards the restricted sense of Connotation, though he did not distinguish it from the *Subjective Intension* and *Comprehension*, which Proper Names of course possess. The name is detachable, and can be transferred to any number of other individuals. It is a peculiarity of Proper Names that when they are thus transferred from one individual to another their meaning changes *totally*. A similar transfer of a common term hardly seems to affect its meaning at all." (p. 38)

It appears to us that Mill's error is mainly due to his loose use of the word "connotation." Of course it would be incorrect to say that a name could denote without connoting, since it is the connotation which determines the denotation and the meaning resides in connotation. A thing could not be distinguished except through its attributes which serve as the basis of its distinction. In the strict sense, therefore, it is not true to say that Proper Names are non-connotative. If they had no meaning, why should they be attached to an individual ? To quote Dr. Bosanquet " A Proper Name, then, has a connotation, but not a fixed general connotation. It is attached to a unique individual and connotes whatever may be involved in his identity, or is instrumental in bringing it before the mind." (p. 93)

10. Inverse Variation of Extension and Intension.—

If we compare two terms, a higher as 'animal' and a lower like 'man,' we find that the former has the greater extension, since 'animal' is applicable to much besides 'men'; while the lower term has the greater intension, (and less extension), e.g., we mean by 'man' more than by 'animal.' Let us look at the following terms arranged in a serial order:—



Here as we start with 'ship' which is the most general term and consequently has the greatest extension and the least intension, we find that as the extension decreases from 'ship' to 'steamship' etc., so the intension increases. When we say 'steamship,' it adds to the intension of 'ship' the additional quality of being propelled by steam. Then again 'Steel steamship' adds another quality of being made of steel only, and so on. Similarly 'man' has greater extension but less intension than 'Socrates.' On this observation is based the **Law of Inverse Variation of Extension and Intension**, which states that extension and intension *vary inversely*, i.e., if the extension increases, the intension diminishes, and if the extension decreases, the intension increases.

Macleane* observes: "All that the inverse variation of Intension and Extension means is that if you 'enlarge your conception' of a term (diminish its intension) you necessarily allow more objects to come under it, whereas if you narrow your conception (add to the meaning you put upon a name) you necessarily exclude objects from it which otherwise would be included."

This inverse relation of Denotation and Connotation must not be treated as a "law." Such relation is not mathematically true, since there is no meaning in a numerical comparison of attributes and individuals, and the addition of one attribute will exclude sometimes more and sometimes fewer individuals.† It is not true that whenever the number of attributes in the intension is doubled (or halved) the number of individual cases in the extension will be exactly halved (or doubled). Again, we may like to give a fuller account of the intension of a term by adding some attribute, but it will not necessarily affect its extension, e.g., "Swan"—"White Swan." Then, again, the extension of a term is increased by the birth of new individuals,‡ but it does not affect the intension. Thus the rule of the inverse relation is not literally true.

* *Reason, Thought and Language*, p. 147.

† Read Bosanquet, *op-cit*, p. 94, Keynes, *Formal Logic* (2nd ed.), p. 33, Joseph, *op-cit*, p. 127 & 133, Schiller, *op-cit*, p. 34. A. Sidgwick *op-cit*, p. 101, Joyce, *Principles of Logic*, Longmans, 1908, p. 28.

‡ If we use 'extension' in the sense of 'all the individuals to which the term is capable of being applied,' and not *actually applied*, then it is not increased by the birth of new individuals.

The general meaning, however, of this doctrine is that any sub-class is smaller in extent than the class out of which it is drawn, while its intension is larger by the *specific difference*. By the increase in the extension the *true intension* of a term is not necessarily decreased. The true intension of a term is not 'the minimum of meaning' with which we use it, but its 'full meaning.'

11. The following are a few Examples of classification of Terms :—

'Man'—categorematic ; univocal ; concrete ; general ; positive ; connotative.

'Museum'—categorematic ; equivocal (*building or a collection of curious objects*) ; in the first sense it is concrete, general, absolute, positive, connotative ; while in the second sense it is concrete, general, collective, absolute, positive.

'Blindness'—categorematic ; univocal ; abstract ; singular ; absolute ; privative ; non-connotative.

'The Indian Cricket Eleven'—categorematic ; univocal ; concrete ; singular ; collective ; absolute ; positive ; connotative.

'Knowledge'—categorematic ; univocal ; abstract ; singular ; absolute ; positive ; non connotative.

Similarly classify the following terms :—'University,' 'Calcutta University,' 'Unlucky,' 'Lawless,' 'Mankind,' 'Lane,' 'Beautiful,' 'The smell of this

flower,' ' Wicked,' ' Incapacity,' ' Bank Holiday,' ' Excursion,' ' Ignorance,' ' Invalid,' ' Refreshment,' ' War.'

SUMMARY.

The true unit of thought is the **Judgment** (whose verbal expression is the **Proposition**) and not the **Concept** or the **Term**.

A **Term** is one of the elements into which we analyse a **Judgment**.

A **Proposition** may contain several *words*, but there cannot be more than two *terms* in a judgment.

Kinds of Terms :—

- (1) { Categorematic, *e.g.*, man, dog.
Syncategorematic, *e.g.*, to, but, only.
Univocal, *e.g.*, town, chair.
- (2) { Equivocal, *e.g.*, bark.
Analogous, *e.g.*, foot.
Concrete, *e.g.*, man, table.
- (3) { Abstract, *e.g.*, kindness, redness.
Singular, *e.g.*, Plato, the earth.
- (4) { General, *e.g.*, man, king, sea.
- (5) { Relative, *e.g.*, husband-wife, parent-child.
Absolute, *e.g.*, water, tree, table.
Positive, *e.g.*, liberal, water, gratitude.
Negative, *e.g.*, illiberal, ingratitude, not-water.
- (6) { Private, *e.g.*, blind, dumb.
Connotative, *e.g.*, man, world.
- (7) { Non-connotative, *e.g.*, London, Plato, whiteness.

A Term signifies the subjects directly, the attributes indirectly; it *denotes* the subjects and implies or *connotes* the attributes (Mill). The Denotation (made up of individuals) is also called **Extension**, and the **Connotation** (made up of attributes) is called **Intension**.

All terms have some meaning, hence they are *connotative*. There is, however, some room for doubt with respect to (a) Proper Names and (b) Abstract Terms, which are usually regarded as *non-connotative*.

It is sometimes said that the **Extension** and the **Intension** of a term "vary inversely", *i.e.*, the more (or less) there is of the one, the less (or more) there is of the other. But this is true only in a broad sense and must not be interpreted mathematically. It only means that any sub-class is smaller in extent than the class out of which it is drawn, while its intension is larger by the *specific difference*.

CHAPTER II.

THE CATEGORIES.

1. **What are Categories?**—The word ‘category’ means predicate ; so the Categories (or Predicaments) are known as predicates of existence, or the modes of Being we can predicate. In other words, they are the predicates that the *copula* ‘is’ attaches to the subject. There is good deal of controversy on the question as to whether ‘being’ is to be taken in the ontological sense of ‘real existence’—in that case, the Categories would be regarded as *kinds of existence*—or in the logical sense of ‘formal existence’—according to which the Categories should be considered as so many ultimate *forms of thinking about reality*.* Aristotle described them as ‘kinds of ways of saying ‘is.’’ But this expression is not free from the ambiguity referred to. We know, on Mr. Joseph’s authority, that the underlying idea of the Aristotelian doctrine of Categories is “to discover the forms of existence which must be realised in some specific way in the actual existence of anything whatsoever.” If we ask what a subject is *in itself*—not in its relation to the predicate of a judgment—the answer is that it must be one or other of the predicates, called Categories. Some logicians hold that the

* “If we are to understand by the *Categories* the logical forms of thinking Reality, Logic knows only one : the Idea or Concept. In this concept it exhausts its being ; hence all those other categories which are usually adduced must be regarded either as mere *nomina* or as not true logical categories”—*Windelband*.

original purpose of Aristotle in drawing up a list of Categories was to enumerate the various forms (existing in the Greek language) of the possible predicates of a Subject as such, and that he was guided neither by logical nor by ontological considerations.* That this view is not impossible is further proved independently by the fact that the father of Hindu Dialectic (named Kanâda) also used the Sanskrit word *padârtha* for the similar notion of Categories, and this word literally means ' the meaning of a word ' (which is partly determined by grammatical forms), *i.e.*, the possible implications of the Subject. But the Hindu logician considered Logic and Metaphysics ultimately inseparable, and his Categories may be taken as the results of reflection not only on the purely logical forms of existence but also on the ontological forms of reality, *i.e.*, the modes of actual existence. In fact, if Formal Logic insists on a separation of the purely logical and the real, the doctrine of categories will present insurmountable difficulties. This is, however, no place for entering into such discussion.† We now pass on to the list of categories as given in Aristotle.

2. Aristotle's Categories.—These are ten in number, and are as follows :—(1) Substance, (2) Quantity, (3) Quality, (4) Relation, (5) Place, (6) Time, (7) Posture; (8) Habit, (9) Action, (10) Passivity. They

* This view upheld by Trendenburg and others is rejected by Mr. Joseph.

† For the different views see J. O'Byrne Croke's *Logic* (Robert Sutton, London, 1906,) p. 51.

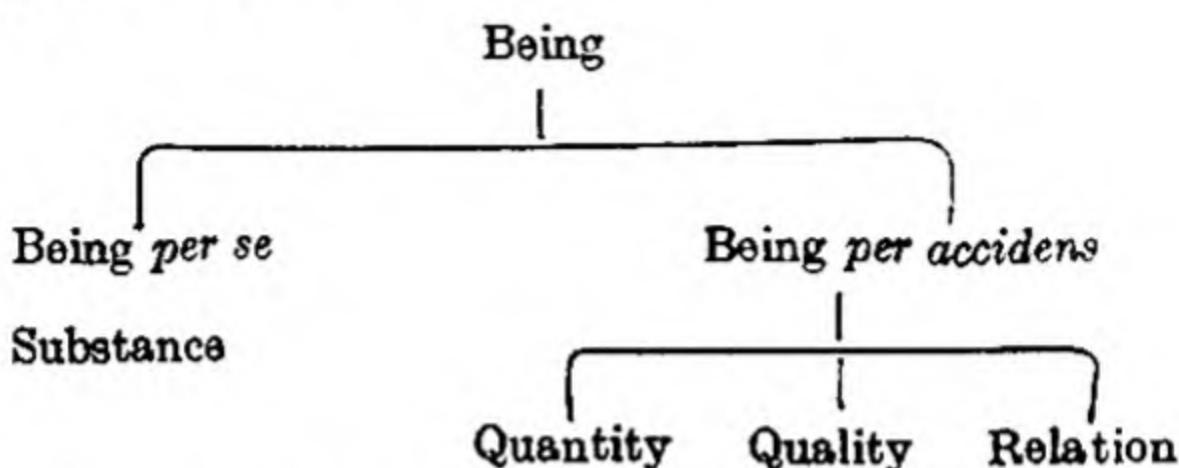
may be illustrated in the case of an individual. As man, he is *substance*; as *quantity*, he is about six feet in height or about two maunds in weight; as *quality* he may be an actor, a physician, a professor, a musician, skilful, wise, etc.; as to *relation* he may be like his brother or unlike his friend; he may be in London or in Paris (*place*) it may then be January 1917 (*time*); he may be standing in front of a window (*posture*); dressed in morning coat and with a stick in hand (*habit*); smoking a cigarette (*activity*); and feeling very cold (*passivity*). The following stanza is another concrete illustration of all the ten categories:—

“A lady stout, too warmly clad,
At Bow, one summer day,
Walking a mile to see her son,
Was melted quite away.”

Considered as an enumeration of Existences or of modes of being, Aristotle's list appears to Mill at once redundant and defective. But the list that Mill himself proposes as an amendment is no less faulty.* But one thing is clear. Unless the Categories are taken in the ontological sense as 'modes of Being,' the subject cannot be a *Substance*, and this category will therefore become meaningless. Again, these ten categories are reducible to two only, *viz.*, Substance and Relation, all the remaining ones being various forms of Relation.

* For a criticism of Mill's scheme see Joyce, *Principles of Logic*, p. 147.

Hamilton, who held the Categories in their metaphysical sense as all things conceivable, proposed the following scheme :—



The category of "Relation" includes the last six categories of Aristotle.

Aristotle's Categories were reduced to the following four by the Stoics :—(1) Substratum, (2) (Essential) Property, (3) (Unessential) Quality, (4) Relation.*

3. Kant's and Hegel's Categories.—Kant too found fault with Aristotle's list of categories inasmuch as it included derivative conceptions. Kant gives a list of his own, which are not modes of being in the above sense, but are 'forms' which our mind applies to things to make experience possible. He is more concerned with the psychology of knowledge than with a mere classification of the forms of existence. He holds that we cannot *perceive* an object except in Space and Time, and cannot *conceive* it except under the forms of the understanding called Categories.† While Aristotle's

* See Ueberweg, *Logic*, p. 119.

† "reine Verstandesbegriffe" (i.e., "pure concepts of the understanding")—Kant. He distinguishes his 'categories,' as in themselves empty thought-forms, from their objective application to time-and-space perception.

standpoint was *objective*, an analysis of the modes of being, Kant's was *subjective*—an analysis of the modes of synthesis on the part of our thought. Kant derives his 12 categories from 12 Judgments. The following is his list :—

	Quantity.	Quality.	Relation.	Modality.
Judgments	1. Singular (This is S P)	4. Affirmative (S is P)	7. Categorical (S is P)	10. Problematic (S may be P)
	2. Particular (Some S is P)	5. Negative (S is not P)	8. Hypothetical (if S is P, Q is R)	11. Assertorio (S is P)
	3. Universal (All S is P)	6. Infinite (S is not P)	9. Disjunctive (S is P or Q)	12. Apodictic (S must be P)
Categories	1. Unity	4. Reality	7. Substance	10. Possibility
	2. Plurality	5. Negation	8. Causality	11. Existence
	3. Totality	6. Limitation	9. Reciprocity	12. Necessity

This list too is not perfect. Some critics accept only the first three categories, while others recognise Substance and Causality only. It is obvious how in such classifications metaphysical or epistemological principles also enter into the purely logical categories.

Hegel regards Kant's Categories as more or less arbitrary and loose in arrangement, and proposes his own scheme which, he says, has a deeper and inner connexion.* He identifies thought and being and thereby unifies form and matter. Logic is thus identical with Metaphysics and so with the whole of Philosophy, which may be defined from this standpoint as *the science of the eternal categories*, i.e., of the necessary determinations of

* In our opinion, however, Hegel's Categories are more artificial and arbitrary than those of Kant. Besides, Hegel's categories are not mere logical forms, but the archetypal forms of Spirit and of Reality.

reality. The following is his table of categories, which also shows their further systematic development * :—

1. Being ("Sein")	... {	Quality
		Quantity
		Magnitude.
2. Essence ("Wesen")	... {	Ground
		Appearance
		Actuality ... {
3. Concept ("Begriff")	... {	Substantility
		Causality
		Reciprocity
4. 'Categories' in Hindu Logic.	Subject ... {	Notion
		Judgment
		Syllogism
4. 'Categories' in Hindu Logic.	Object ... {	Mechanism
		Chemistry
		Teleology
4. 'Categories' in Hindu Logic.	Idea ... {	Life
		Knowledge
		Absolute Truth

—It may be of some interest to the student of Logic to know how many categories were recognised in ancient Hindu Logic. Kanâda, the founder of the *Vaisheshika System* enumerates six categories, called PADARTHA, and they are :— (1) Substance ("Dravya"), (2) Quality ("Guna"), (3) Action ("Karma"), (4) Community ("Sâmânya"), (5) Difference ("Vishesha"), and (6) Permanent Inherence ("Samavâya"). Later on a seventh category, viz.,

* Lask has exhibited a sketch of another trilogy of the system of categories, divided into the spheres of (i) validity (ii) being, and (iii) the super-existential.

Non-existence ("Abhâva") was added.* Kanâda's system is, in fact, nothing but a scientific exposition of the categories. The Categories are the ultimate forms of Reality, a right knowledge of which leads to complete freedom from pain, which is *moksha*, the *summum, bonum* of life. Thus Kanâda's system is more, much than mere logic ; it includes metaphysics, psychology, theology as well, and its categories are not the mere logical forms of our thinking.

SUMMARY.

Categories are the fundamental modes of Being, or the predicates that may be attached to the Subject in itself (i.e., considered 'out of syntax'). They are also known as Predicaments.

Opinions differ as to whether the categories refer to names, or notions, or things, or all three. They have been variously regarded as an enumeration of—

- (1) All things capable of being named ; an enumeration of the *summa genera*, i.e., the most exhaustive classes into which things could be distributed. (*Pre-Socratic thinkers and the Schoolmen* ;—also *Kanâda*).
- (2) The different grammatical forms of the possible predicates of a proposition, viewed in relation to substance as subject. (*Mansel and Trendelenburg*).

* “द्रव्यं गुणस्था कर्म सामान्यं सविशेषकम् समवायस्थाऽभावः पदार्थः सप्त कौत्तिताः”—कारिकावली ।

- (3) The different significations of simple terms, apart from their connection in the proposition.
- (4) The several genera under which Aristotle's four heads of Predicables fall. (See Ch. III).
- (5) The different modes in which Being may be signified. (*Adams*).
- (6) The different classes to which are reducible all the objects of our thought comprising all *substances* under the first, and all attributes under the nine others. (*Port Royal Logic*).

Aristotle has enumerated the following ten Categories : **Substance, Quantity, Quality, Relation, Place, Time, Posture, Habit, Action and Passion.** (For other lists see above).

Categories as the logical forms of thinking. Reality should be distinguished from categories as the archetypal forms of Spirit and of Reality (as in Hegel).

CHAPTER III.

THE PREDICABLES.

1. **Their Meaning.**—In the last chapter we have dealt with Categories, which we described as distinctions of terms according to the nature of their meaning. (Now we shall speak of another division of terms, based upon the *relation* in which the predicate may stand to its subject in a proposition. Such relations are known as **Predicables**.) While Categories had a reference to terms 'out of syntax,' Predicables view them only in their syntactical relation *in* a judgment. In scholastic phraseology, Categories refer to *first intentions* and Predicables to *second intentions*. Categories are evidently more abstract than Predicables. Both are *predicates*; but the former are referred to a term by itself, according to its meaning, the latter to a term only as subject in a logical proposition. Take the proposition "Man is mortal." If we take the subject 'man' and try to find out the possible meanings of the copula 'is' we will have Categories. If we try to find out its various relations to the predicate 'mortal' we will have Predicables.

2. **The Five Predicables.**—According to Aristotle there are five * ways in which a predicate might be related to its subject in a judgment, we may state (1) the **definition** of the subject (e.g., man is a *rational animal*) ; or (2) the **genus** (e.g., man is *an animal*) ; or

* Originally *four* relations (excluding *Differentia*) were recognised by him, but one of them was sub-divided, thus making up *five*.

(3) the **differentia** from the genus (e.g., *rational*) ; or
 (4) a **property** (i.e., any attribute applicable to the whole class but not expressed in the definition) ; or
 (5) an **accident** (i.e., any attribute not common to the whole class).

These relations hold good only when the subject is a "kind" (*species*) and not an individual. For instance they will apply to "man" but not an individual such as "Plato." The scope of the **predicables** was thus limited. Later on, in the 3rd century A. D. (i.e., about 600 years after Aristotle) Porphyry attempted to extend their scope so as to make them applicable to individuals as well. And as an individual *qua* individual has no *essence*, no *definition* is possible, although we can mention his *species*. Thus Aristotle's **predicable Definition** was rejected and a new one, *viz.*, **Species**, was substituted. The following are the **Five Heads of Predicables** first named by Porphyry and became traditional ever since:-

Predicables are { 1. Genus
 2. Species
 3. Differentia
 4. Proprium
 5. Accidens } of the Subject

3. **Definitions of the Predicables.**—The following are the simplest definitions*:-

Genus is a larger class viewed in relation to some smaller class contained under it ; or, in other words, a wider class made up of narrower classes.

Men are *animals*. (genus).

* See also Stock, *Logic*, ch. VI ; Welton, *Manual of Logic*, vol. I., p. 80 ; Joseph, *op. cit.*, p. 59ff.

✓ **Species** is a smaller class viewed in relation to some larger class under which it is contained ; in other words, a narrower class included in a genus.

Some animals are *men* (species).

✓ **Differentia** is the attribute or attributes which distinguish a species from a genus. It is the distinguishing part of the essence of a species ; in other words, 'the property which marks off a species.'

Men are *rational* (differentia).*

✓ **Proprium** is an attribute which is not contained in the definition of a term but which follows from it. It is an attribute common and peculiar to a subject, but not part of its essence (and so not included in the definition). It is *generic* if it follows from the 'genus,' and *specific* if following from the 'differentia.'

Men can swim (generic property).

Men can deliver a lecture (specific property).

✓ **Accidens** is an attribute which is neither contained in the definition of term nor follows from it. It includes all attributes other than those coming under *Differentia* or *Proprium*. It is an attribute which is not included in the essence, and it may or may not belong to a subject. Some 'accidents' are termed *separable*, others *inseparable*. The former are those which belong only to some members of a class, *i.e.*, which can be thought away from the individual ; while the latter are those which belong to every member of a class.

* *Genus + Differentia = Definition* ;

e.g. "Men are rational animals."

Differentia. Genus.

This distinction is applicable both to a class and to an individual. An *Inseparable Accidens* of a class is one which belongs to every member of the class ; while in the case of an individual it belongs to him at all times and can never be changed.

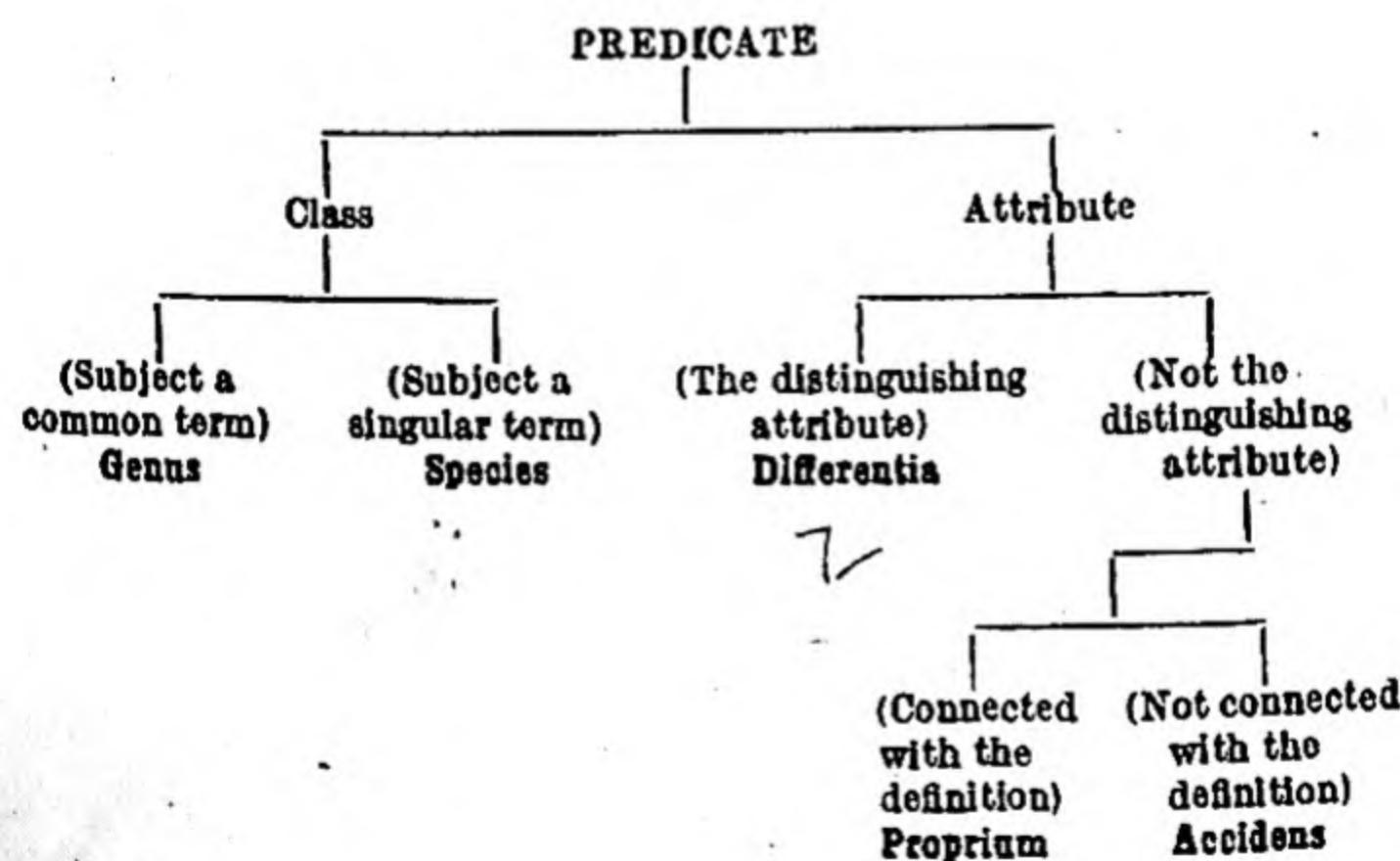
All ruminant animals are cloven-footed (inseparable accidens).

Some animals have four legs (separable accidens).

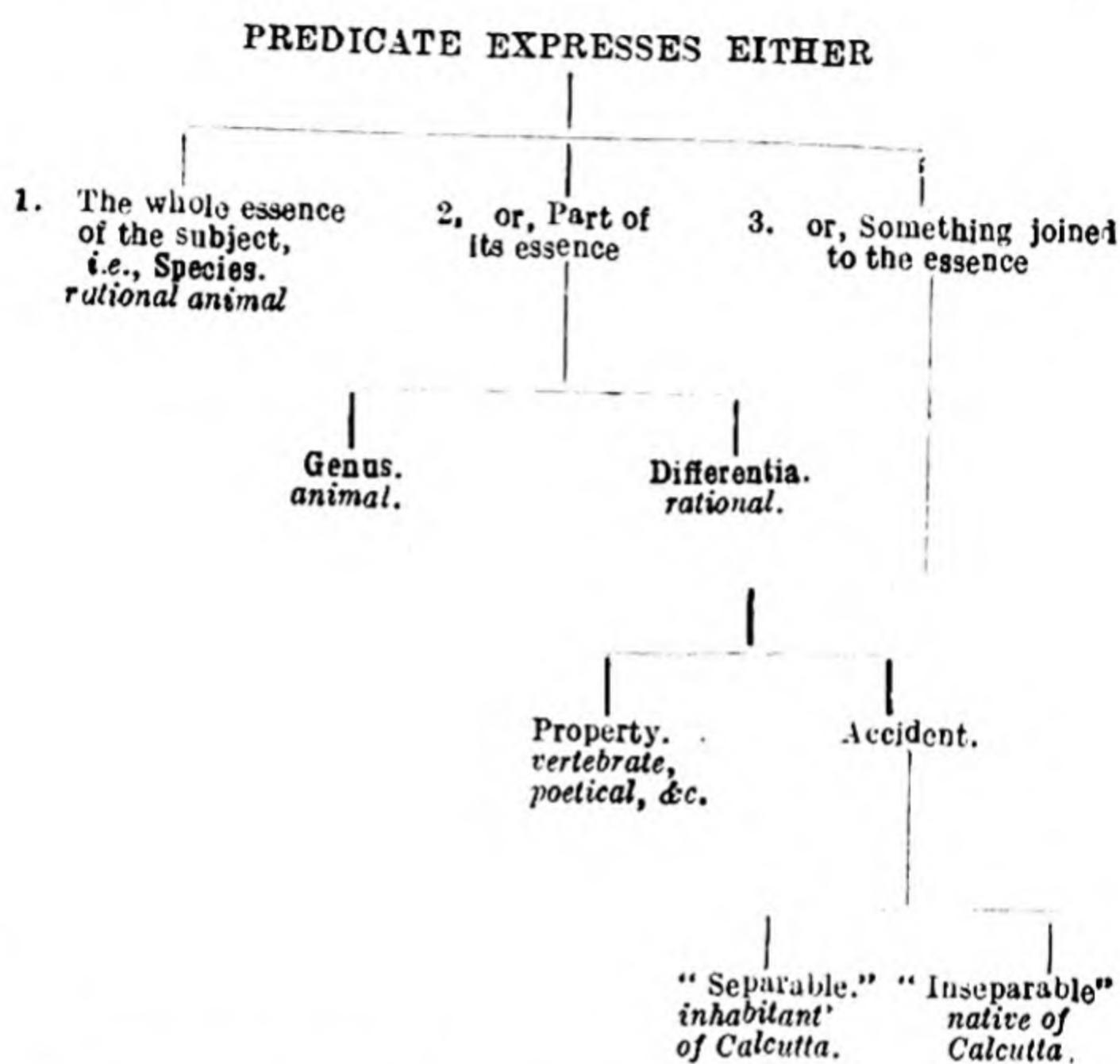
Kant was a Professor of Philosophy (separable accidens).

Kant was a native of Königsberg (inseparable accidens).

The first two predicables, *viz.*, Genus and Species, refer to classes expressed by a noun substantive, while the remaining three refer to attributes expressed by adjectives. The following scheme shows the distinction :—



The following is a fuller and more detailed scheme :—



The nearest genus to every term, of which that term is itself a species, is called the *Proximate Genus*. If a term is so general that it is not a species of any more general term, it is called a *Summum Genus*; and if it cannot be further divided into species but only into individuals, it is called an *Infima Species*.

4. General Observations.—The Aristotelian and the Porphyrian lists of predicables have been given. It now remains to be stated that with the advancement of knowledge, in particular of modern science, these lists have had to lose much of their former importance.

The theory of evolution has told us that species are not immutably fixed. The relation between *genus* and *species* cannot, therefore, be looked upon as fixed and rigid. Our definitions cannot be true for all times, since it is possible that the *essence* of any class may undergo development with our increasing knowledge. No absolute limits can be marked. Then again, as Mr. A. Sidgwick observes, "the notion of a 'property' as distinct from the *essence* has lost its value in use. Under the old scheme a property was deducible from 'the' definition without being actually a part of it, but with a variable definition this distinction becomes unmeaning; besides, why should we care to distinguish between an essential quality which a definition happens to mention expressly and one which is only tacitly implied?" * Yet we are inclined to say that the *predicables* are not useless on that account. You may not care to distinguish the "essence" from the "property" but then you make all definitions impossible. A definition cannot undertake to state *all* properties of the species, but only those which are "essential". Some such understanding is necessary in order to simplify logical procedure. And although to each individual taken separately the limits of "essence" may vary, for a developed intelligence there is not generally any abrupt variation. Individual knowledge has gradually to discover much that is already discovered by more advanced consciousness. Hence the distinctions on which the theory of *Predicables* is based are not to be

* *Op. cit.* p. 109.

ridiculed as such. If the **Predicables** are taken in a purely logical sense no fault can be found with them even by the upholders of the "new" Logic. It is only when they are taken in their ontological aspect that difficulties present themselves. It is not, however, our present purpose to enter into such discussions at all. The question can at best be answered by metaphysics.

SUMMARY.

Predicables are the relations of the predicate to the subject of a logical judgment. They do not express what a term is by itself, but only its relation as predicate to the subject of the judgment (or proposition).

Predicables mean all the possible modes of predication, *i.e.*, all that can be logically asserted about any thing, while **Categories** mean the predicates themselves. The former are designed for a classification of all the possible relations between our thoughts, the latter for a classification of all the possible things, about which we can discourse.

There are five **predicables** traditionally recognised since Porphyry, *viz.*, (1) **Genus**, (2) **Species**, (3) **Differentia**, (4) **Proprium**, (5) **Accidens**. Aristotle, however, named only *four* **predicables** one of which was subdivided.

The ontological validity of the **Predicables** has generally been questioned, especially since Darwin exploded the old belief in the fixity of species. But in their purely logical aspect their utility must be recognised.

CHAPTER IV.

DEFINITION OF TERMS.

1. **Nature and Function of Definition.**—Definition is the precise statement of the connotation (i.e., the meaning) of a term. It states all the fundamental qualities characteristic of the thing denoted. It is impossible to specify *all* the attributes which may be suggested by a term—as a matter of fact we cannot claim to possess such complete knowledge—only those being taken into account that are usually recognised by competent thinkers to be the most essential, i.e., without which a thing will cease to be what it is. Thus in the definition “Man is a rational animal” it is evident that man would not be man if ‘animality’ or ‘rationality’ were taken away from his characteristics. According to Aristotle, a definition gives us the ‘why’ of a thing. It is, as we know, in the form of a proposition in which the subject is the term to be defined and the predicate is the number of essential characteristics or the connotation of the term. The question whether a definition applies to ‘things’ or to ‘names’ only will be touched upon below. Here we might point out that the proper function of definition is to remove ambiguity from our thought and to make it clear. { We express our thought by language, and unless we have clear and distinct ideas in our mind based upon clear distinctions in our thought, our expression is bound to be ambiguous. Besides, we generally use words whose meanings may be many and indefinite, and unless we analyse them

properly there will arise a confusion in our thought and expression. Pascal was right in insisting that we should never use terms that are not clearly understood by all. Most of the terms in every language are equivocal ; hence in the interest of correct thinking it is necessary to fix their meanings by precise definitions. The process of forming definitions is not easy ; it requires great patience, careful observation, comparison, analysis, abstraction, etc.

2. Definition 'per Genus et Differentiam.'— The procedure of stating all the essential attributes implied by a term is rather cumbrous, as in many cases it requires a long list of attributes to be named for this purpose. Hence we employ terms which express certain classes or groups of attributes in order to construct a brief definition. This is done by stating the Genus (which implies all the attributes possessed by the species to be defined in common with other species belonging to the same genus) and adding the differentia, which distinguishes that species from all other species of the same genus. Thus when defining a term we first mention the class to which it belongs and then state the attributes which mark it out from other members of the class. This is meant by the old rule that our definition should be *per genus et differentiam*. It will, however, be easy to see that while stating the genus, we should be careful to specify a proximate genus ; otherwise our definition will omit part of the connotation of the term defined. It is a very convenient and practical way of definition, although such definitions are by themselves

not complete, since they are not a complete statement of the connotation of the term defined but presuppose a knowledge of the essence of the proximate genus. Tradition has adopted the method of defining *per genus et differentiam* mainly because of its practical advantages. The following scheme will show the convenience and advantage of defining *per genus et differentiam*. We first define 'Omnibus' and have in view its distinction from 'Tram.'

Genus: Four-wheeled public vehicle.

Species: Omnibus.
Differentia: Not confined to rails.

Tram.
Confined to rails.

When we state the genus, *viz.*, 'four-wheeled public vehicle' it obviously includes 'Tram' as well; hence we add the differentia 'not confined to rails,' which distinguishes 'Omnibus' from 'Tram' which is confined to rails. Now, if we compare the terms 'Omnibus' and 'Cab' we will have to add another differentia, thus—

Genus: Four-wheeled public vehicle, not confined to rails.

Species: Omnibus.
Differentia: Keeping to well-defined routes.

Cab.
Not keeping to well-defined routes.

Thus 'Omnibus' has now been further distinguished from 'Cab.' Hence, by such comparison we now form the definition of 'Omnibus' by saying that it is 'a four-wheeled public vehicle, keeping to well-defined routes,

and not confined to rails.' Thus the formation of Definition involves comparison, abstraction, etc.

3. Limits of Definition.—The purpose of Definition being the unfolding of *meaning*, it is obvious that terms which are non-connotative cannot be defined. Proper Names cannot therefore be defined. Also Singular Abstract terms cannot be defined, since they imply a simple attribute which cannot be analysed into simpler attributes. That is why feelings cannot be adequately expressed in language. One can only feel 'pleasure' and 'pain,' 'happy' and 'sad,' but cannot exactly define them in words. So too 'whiteness,' 'greenness,' etc., cannot be defined.

Proper Name *sare in a sense* definable. They do not have any meaning of the signification but only the meaning of the sign. Thus, we can say, "Rue de Rivoli is the name of a street in Paris." This is only defining the meaning of the sign "Rue de Rivoli." Such a definition of Proper Names does not state the *essence* of the thing defined.* We can, however, *describe* (if not *define*) the individual by selecting a sufficient number of its qualities to distinguish it from other individuals of its kind. The individual is only described while the species is defined.

* 'Real' definition is a statement of the *real nature* of the species defined. Real nature means both *existence* and *essence*. All definition whether of Proper or General names implies *existence*; and definitions of General names state the *essence* as well, while those of Proper names do not.

In definition, we cannot start from anywhere below the *Infima Species*, since among individuals no specific differences exist, and since the *names* of individuals do not mean "essence"; nor could we go beyond the *Summum Genus*, since there could be no higher genus in which it would be included as a species. In this way, the lower as well as the upper limits to Definition are set down. But with the growth of our knowledge these limits are shifted a little upwards or downwards. In all cases, definitions are not *rigid* and *immutable*, but *provisional*. With the change in our point of view or in our purpose, the definition may also change. As we have already shown, changes in the denotation and connotation of terms are possible and it is obvious that they will affect definition. If our knowledge were complete, then final and immutable definitions would be possible and there would be no meaning in discovery, but to our finite intelligence knowledge is all along a discovery and a gradual growth and that is what makes science possible. Dr. Schiller observes (p. 67) :—“It is in flat contradiction with the method of science to assume a limit to its progress. Finality may appeal to us as mortals, but it cannot be our ideal as scientists.”

4. Do we define Things, Words, or Meanings?—This is the question that has been the subject of im-memorial controversy. We have already remarked that only universals (and not individuals) can be defined in the true sense. The question then arises as to what these universals actually mean. Do they stand for actual things, or are they mere words or names

(which means that only the individuals exist), or do they imply only a logical meaning?

This controversy has been carried on by three schools:—

(a) **Realists**—who maintained that universals implied a reality which was on the whole independent and superior to that of the particulars. Plato held that 'universals were *before* things' ('*universalia ante rem*'), while according to Aristotle they were *in* things ('*universalia in re*'). According to one, the universals transcended, and were quite independent of the particulars; while according to the other, the real world was only *one*, and the universals were *in* things, being the common nature of the particulars.

(b) **Nominalists**—who held that the universals were neither *ante rem* nor *in re* but *post rem* (i.e., after the particular things). In other words, they were mere *names*, merely convenient words, and nothing more. Things called by the same name had nothing except the *name* in common. The universals were only verbal conveniences ('*flatus vocis*'). Only the particulars existed and there was nothing like a universal nature existing within or beyond or before them.*

* Mill emphatically holds that definitions are of *names* only.

(c) **Conceptualists**—who adopted a more or less middle course between Realism and Nominalism. They have been called 'less extreme Nominalists.' They hold that universals are not mere words but are real as concepts, as psychic facts ('*universalia in mente*'). Universals imply 'meanings' or 'ideas' or 'concepts.' They are "the instruments whereby our thought classifies the overwhelming variety of phenomena." Thus, they believe, the true universal is neither a thing nor a name but a concept.

This controversy was very prominent during the Middle Ages. The champions of Realism referred back to Plato and Aristotle, and those of Nominalism to Antisthenes. *Logical* Realism (which is opposed to Nominalism) should not be confused with *metaphysical* Realism (which is opposed to Idealism), according to which a real world exists independently of a mind to perceive it.

A true view of the nature of definition will avoid all these extremes. Thus, in so far as our definition aims at making our meaning clearly and distinctly understood, it is of *names* without a reference to objective reality, but as definition does not propose to exhibit merely the sound or syllables of a word or name, hence it must have reference to *meaning*; but as such meaning or concept is only a psychic fact or a mental image, it must be related to the particular things in some way; hence definition is of things only as 'species' and not as

‘particulars.’ For instance, the term ‘horse’ would mean not simply any particular horse, this or that, but an idea or a species that covers all particulars and yet is not completely identified with any one of them. It was for this reason that Hindu logicians always affixed *-tvam* to the term to be defined in order to make it a *jāti*, a class-name. Thus not *ghata* (a jar) but *ghatatvam* will be defined.

We see, therefore, that as universals do not actually exist as ‘things,’ we must reconcile, if possible, the standpoints of nominalism and conceptualism. Definition is of meanings but all the same it may also be regarded as verbal definition. Mr. Boyce Gibson observes: “All definition of meaning is at the same time verbal definition, and *vice versa*. The distinction between nominalism and conceptualism, in definition, is a distinction without a difference.”*

5. Kinds of Definition.—Aristotle recognised a distinction between **Real** and **Nominal** definitions. The former stated the essence, while the latter stated only the meaning of words and nothing as to the existence of corresponding objects. We are, however, told by Dr. Schiller that Aristotle’s treatment of these two kinds of definition was obscure, and that his “*real* definition became in practice nominal, whereas his *nominal* definitions actually succeeded in conveying real information.” Some logicians (e.g., Mill) hold that all

* *Op. cit.* p. 25. For further discussion see Bosanquet’s *Logic*, Vol. I, pp. 148, 210, etc., also F. H. Bradley’s *Principles of Logic*, Bk. I, Sect. 38, and Bk. II, Part I.

definitions are nominal: that they do not tell us anything about the nature of a thing but only the meaning of a word. So far this view cannot be accepted. Mill, however, is careful to add that the definition of the meaning of a name is not arbitrary but implies a study and comparison of the things denoted. In other words, Mill does not deny that the definition of a name has reference to its meaning.

Aristotle distinguishes two kinds of *nominal* definitions*—(1) those which signify imaginary objects, to which nothing actual or possible belongs, e.g., "a dragon is a serpent breathing flame"; (2) those in which the essential properties of a thing cannot be stated and a sufficiency of attributes is selected for description, e.g., "thunder is a noise in the clouds."

The distinction of Real and Nominal has now fallen into disuse, although it is based on an important principle. It has, however, been substituted by another distinction, *viz.*, *Complete* and *Incomplete* definitions.

A *Complete* definition is a full statement of all the properties implied by the term (cf. Bain). *Incomplete* definitions are of two kinds:—(1) those popularly known as *prefect* definitions, *i.e.*, those that state only a *part* of the connotation of a term, such part, however, being sufficient to mark out correctly the bounds of its denotation, and (2) those popularly known as *Descriptions*, *i.e.*, those that define a term by the accidents of its class, *i.e.*, by attributes not included in its connotation.

* Joyce, *op. cit.* pp. 152ff.

The following is the classification of definitions recognised by the Logic of the Schools :—

(1) *Nominal* definition—that explains merely the meaning of a word.

(2) *Real* definition—that explains the nature of a thing. This is divided into—

(1) *Accidental* definition—that defines by accidents, e.g., "A Negro is a black man." This definition is called *Description*.

(2) *Essential* definition—that is formed by the genus and differentia. This is sub-divided into—

(a) *Physical* definition—that states the denotation of a term or assigns the parts into which the thing can actually be divided.

(b) *Metaphysical* or *Logical* definition—formed by stating the proximate genus and essential differentia. This is the regular Real definition *per genus et differentiam*.

Real definition has another peculiar sub-class named *Genetic* definition, which applies to qualities in time and space. It names those elements only which taken in conjunction result in the production of a thing.

6. Rules of Definition.—We have already stated one general rule, viz., that a definition must be *per genus et differentiam*. Besides that, the following rules should be carefully noted :—

(i) **A Definition should state neither more nor less than the connotation of the term defined.**—In other

words, it should be precisely adequate to the species defined, erring neither by excess nor defect. If it contains more than the connotation, i.e., contains attributes not essential and not forming part of the connotation of the term, then it becomes too narrow. For instance, if "labourer" is defined as "one who performs manual work for wages," it will exclude 'slaves' because they do not work "*for wages*." The term "labourer" should include "slaves" also, but this definition excludes them, as the addition of the separable *accidens* 'for wages' turns it into a faulty definition. So too, "Man is a *cooking* animal," "Man is a *featherless biped*," "Logic is a machine for combating fallacy," etc., are definitions containing more than the connotation, and are, therefore, too narrow. The definition of 'an equilateral triangle' as "a triangle which has three equal sides *and three equal angles*" is redundant, because it adds a property to the connotation of the term "equilateral triangle," and therefore wrongly suggests that there could be triangles having three equal sides and yet not having three equal angles. Hence, a definition should not include the *proprium* or the *accidens*, but only the exact connotation of the term defined.

If, however, it happens to contain *less* than the connotation, then it is obvious that it will be applicable to a greater number of things than are included in the denotation of the term, and consequently will be too wide. For instance, "An equilateral triangle is a plane rectilineal figure having three sides." This definition omits to mention 'three equal sides,' hence it is

applicable to all triangles, as they are 'three-sided rectilineal figures.' So too "A violin is a musical instrument with four strings" is too wide.

If this rule is observed and the definition does not state either more or less than the connotation of the term defined, it follows that the denotation of the term will also be exactly stated. If the denotation is greater, the definition is too wide; if the denotation is less, the definition is too narrow.

(ii) **A Definition should not be expressed in obscure or figurative language.**—Definition aims at avoiding all ambiguity as to the use and meaning of words and enabling us to understand the nature of the thing defined. Hence it is necessary that it must not be couched in vague, obscure or figurative language. The use of obscure or figurative language, although enhancing the beauty of speech, hinders its direct apprehension.

Instances of obscure definitions are: "Fluency is the exuberance of verbosity," "A net is a reticulated fabric, decussated at regular intervals," "Eccentricity is peculiar idiosyncracy." Instances of those expressed in figurative language are: "Pain is the discipline of character," "Bread is the staff of life," "Mind is a blank tablet," "Necessity is the mother of invention," "Variety is the spice of life," and so on. None of these definitions actually explains the meaning of the terms defined. Those who violate this rule are said to explain *obscurum per obscurius*, and such fault is known as defining *ignotum per ignotius* or *per acque ignotum*, i.e., explaining the unknown by the more or equally unknown

It should, however, be noted that technical definitions are not necessarily obscure, though they may appear so to the uninstructed. Most of the definitions in philosophy and the natural sciences are technical and can be understood only by the students taking up these special studies. Mr. Joseph rightly observes "The obscurity forbidden is that which would be acknowledged by those acquainted with the field of study to which the definition belongs." *

(iii) **A Definition should not be tautologous.**—In other words, it should not directly or indirectly contain the term defined.† Neither the term itself nor some of its synonyms should be found in the definition. For instance, the definitions "The sun is a star emitting sunlight," "Life is vitality," "Liberty is freedom," "Truth is veracity in speech and act," "Just is one who practises justice," "Man is a human being," etc., are faulty inasmuch as they contain either the term itself or its synonym. Such definitions are useless, as they fail to give us the real information or knowledge we expect of them. It is obvious that terms which express simple and elementary attributes cannot be defined, since such attributes can only be expressed by the very terms or their synonyms.

This fault of turning definition into mere tautology is technically known as *circulus in definiendo* ('a circle in defining,' 'a vicious circle').

* *Op. cit.* p. 101.

† "The prohibition of *tautologous* definition 'in a circle' meant that a thing's place in nature could not be fixed by its relation to itself"—Schiller, *op. cit.* p. 64.

It is not, however, regarded as a circular definition when the term to be defined is a species having no separate name but distinguished from other species of its genus only by the addition of an adjective. For instance, if we define an "equilateral triangle" as "a triangle which has three equal sides," the term "triangle" appears in the definition because the species "equilateral triangle" has no separate name and is only distinguished from other species of the genus "triangle" by the adjective 'equilateral.' If the meaning of "triangle" is not known beforehand, then such a definition would be useless, but in geometry the definition of 'triangle' always precedes that of its various kinds.

The same fault of 'circular definition' appears in case we define a term by its correlative, e.g., "A whole is an aggregate of parts." "We can define the correlatives 'whole' and 'part' together, but cannot define either of them by the other.

(iv) A Definition should not be negative, if it can be positive.—A definition should tell us what a thing *is*, not what it *is not*. Where, however, it is impossible to form a positive definition, a negative definition may give us *some* information about the species; but, as a rule, a logical definition should, wherever possible, be stated in the affirmative form. Definitions such as—"Health is the absence of sickness," "Virtue is the opposite of vice," "Light is the opposite of darkness," are faulty on this account. They do not give us any positive information. If the term to be defined is

positive, how can its connotation be expressed negatively? The essence cannot be negative, and the possibilities of negation are infinite.

If, however, the term defined is itself negative or privative, negative definitions are allowed—in fact, in such cases they are to be preferred to positive definitions. For instance, "A bachelor is an unmarried man," "Injustice is the not keeping of covenant," "Darkness is the absence of light," etc.

To recapitulate : A definition should be (i) adequate and precise, (ii) clear, and neither (iii) tautologous, nor (iv) negative.

7. Description.—We have already spoken of Description under Incomplete Definition. Description and Logical Definition should not be confounded. A Description usually contains some 'inseparable accidenta' of the term and sometimes a few of the 'properties' as well. It helps us to recognise the objects denoted by the term, but does not tell us anything about its essential qualities. It is not, therefore, entirely useless. Sometimes it is, in fact, more useful than a logical definition, e.g., in the dictionary we generally find descriptions which lead us to recognise the things denoted by certain terms ; we can at once recognise a horse if we know in general how it looks, but if we are furnished with a scientific definition of a 'horse,' however perfect and cogent it may be logically, its direct help is meagre. Description applies to individuals primarily and to species secondarily. Both definition and description distinguish one thing from others, but the former does

so by the statement of the essential qualities, the latter by an enumeration of accidents or properties or both. Definition appeals to thought, description appeals to imagination.

8. Fallacies of Definition.—If any principle of logic is violated, it gives rise to logical error explicitly or implicitly. In the latter case, it is called a *fallacy*. In other words “A fallacy is a violation of logical principle disguised under a show of validity.” We are not concerned here with a discussion of the nature of fallacy in general or of its kinds. We have said above that one of the functions of definition is to remove ambiguity in the use of terms in order to fix the meaning clearly and distinctly in the mind. If ambiguity is not completely removed, certain fallacies arise. The following are their chief types :—

(i) **Equivocation or Homonymia.**—The fallacy of Equivocation results when a term is used which is capable of having two or more senses. A well-known example is—“The end of a thing is its perfection ; death is the end of life ; therefore death is the perfection of life.” Here the word ‘end’ is used in two different senses of ‘aim’ and ‘finish.’ Similar are the following :—

A great bore is to be avoided,

St. Gothard Tunnel is a great bore,

∴ St. Gothard Tunnel is to be avoided.

(Here the term ‘bore’ is ambiguous).

Men who have recovered are well,

The sick man has recovered,

∴ The sick man is well.

(Here the term 'sick man' is used in two different senses: 'one who is sick' and 'one who *was* sick'). This fallacy of equivocation is one of the simplest forms of ambiguity.

(ii) **Figura Dictionis.**—This fallacy of *Figure of Speech* arises through the supposition that words similar in form are similar in meaning. Mill's example is well-known: he argues that because 'visible' means 'able to be seen' and 'audible' 'able to be heard,' hence 'desirable' also means 'able to be desired.' But this is not correct. 'Desirable' means 'what should be desired' or 'what is worth desiring,' and not 'what can be desired.' A traditional example of the same fallacy is: "What a man walks on he tramples on; this man walks on the whole day; therefore he tramples on the whole day."

(iii) **Amphibology.**—This fallacy arises from ambiguity in the grammatical structure of a sentence, e.g., 'The Duke yet lives that Henry shall depose.' Here the ambiguity is obvious inasmuch as it is not clear whether the Duke will depose Henry or Henry will depose the Duke.

(iv) **Compositio and Divisio.**—The fallacies of Composition and Division are the converse of each other, and arise in taking together objects of thought which ought to be kept separate or in separating those which ought to be joined. The following is an example of the Fallacy of Composition:—

One and two are odd and even,

One and two are three,

∴ Three is odd and even.

So also if from the statement that a member of the council is likely to be wrong, we jump to the conclusion that the whole council is likely to be wrong, we commit the same fallacy.

The converse fallacy of Division is illustrated in the argument : 'as all angles of this triangle are equal to two right angles, therefore this angle A B C is equal to two right angles.' The ambiguity rests in the word *all*, and here it has been used in two different senses : 'all together' and 'each individually.' These two should have been kept separate. If someone says : 'all my packets weigh 20 seers' we are left in doubt whether he means 'all packets taken *together*' or '*separately*.'

These are only a few of the large number of fallacies *in dictione* ; they will be treated in detail in Book III, Ch. XI. Here the section on Fallacies of Definition is to be considered only as a supplement to our treatment of Logical Definition.

9. Test Examples Worked Out.—In criticising any definition we must try to find out if it violates any of the principles of logical definition. If it does, we should state how it does so, and then reconstruct our own definition.* For instance, let us test the following definitions :—

(1) 'A soldier is a brave man ready to die for his country.'

Criticism : This is not a definition but an explanation. 'Brave' is superfluous, as its

* Read Boyce Gibson, *op. cit.*, pp. 31—39.

a source of error) seems to feel no difficulty in discovering the *fundamentum divisionis* in each case. In the words of Dr. Schiller, it declares "that it was precisely the relevance of a selection to the purpose of some enquiry that rendered a division needful, possible, and right." (p. 74). Formal Logic, however, would always aim at the possibility of making absolute divisions; it would not attach much importance to the idea of *relevancy* or *selectiveness*.

3. Logical Division distinguished from Physical and Metaphysical.—Logical Division, as we said before, is not an enumeration of the individuals but a specification of the species which compose a genus. These species are themselves *kinds*, general terms. Thus an 'individual' or a singular term is incapable of logical division. Division therefore stops with infima species. There are two other processes from which Logical Division must be distinguished, *viz.* :—

(a) **Physical Division (or Partition)**—the splitting up of an individual into its component parts, *e.g.*, a horse into head, neck, body, tail, etc., a sword into blade and handle; a house into roof, bricks, lime, timber, glass, etc.; a plant into root, stem, leaf and flower.

(b) **Metaphysical Division**—it is a distinction (in thought alone) of the genus from the differentia, *e.g.*, man into animality and rationality. Sometimes it denotes the

distinction of the qualities of an object, e.g., the colour, taste shape, etc., of an apple.

In **Logical Division** the whole which is divided can be predicated of its parts, e.g., 'matter' can be predicated of 'solid,' 'liquid' and 'gas'; in **Metaphysical Division** the parts can be predicated of the whole, e.g., 'animality' and 'rationality' can each be predicated of 'man'; in **Physical Division** neither the whole can be predicated of the part nor the part of the whole, e.g., we can neither say that the 'trunk' is the 'tree' nor the 'tree' is the 'trunk.'

4. Rules of Logical Division.—The following are the principal rules which must be observed in a Logical Division :—

(1) **Each act of division must be conducted on a single basis.**—That is to say, there should be only *one* 'fundamentum divisionis' for each complete act of division. For, otherwise, some members will appear in more than one species and some will be omitted altogether. Thus, if we divide Houses into Castles, Cottages, Gothic and Classical, we discover two *fundamenta divisionis*, viz., size and style. Some Castles may be 'Gothic' while others may be 'Classical.' Similarly, the division of Politicians into Liberals, Radicals, Conservatives, Home Rulers and Unionists is also faulty, as all Conservatives and some Liberals are also Unionists. These are *cross-divisions* resulting from a violation of this rule.

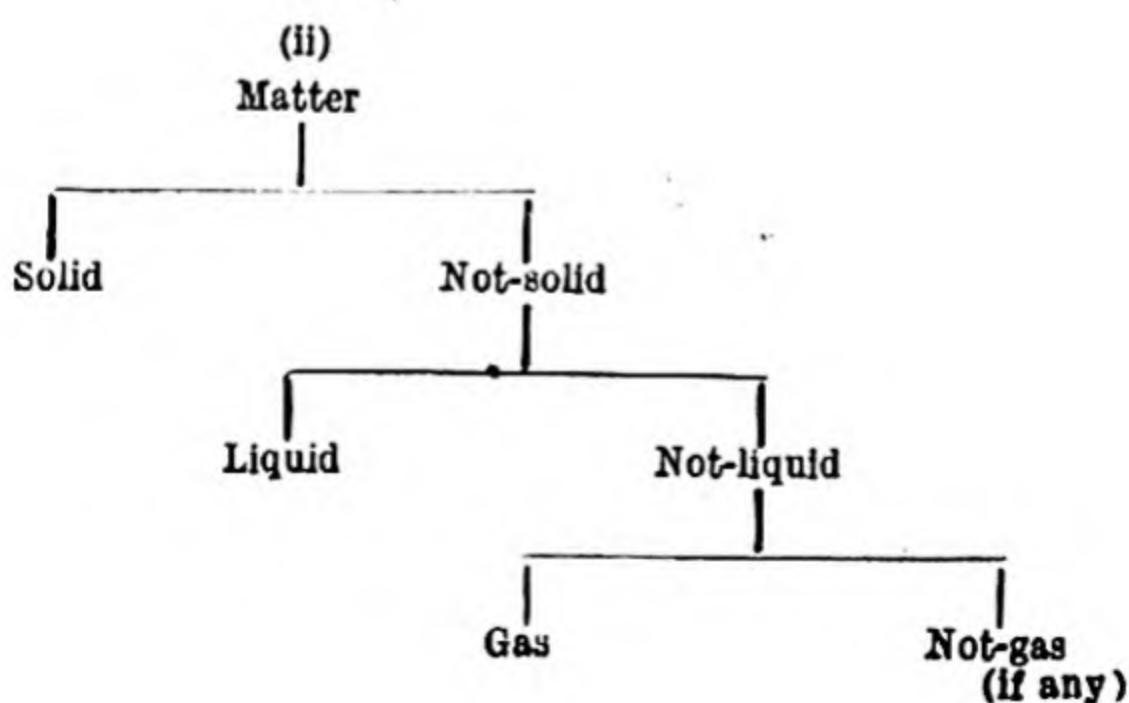
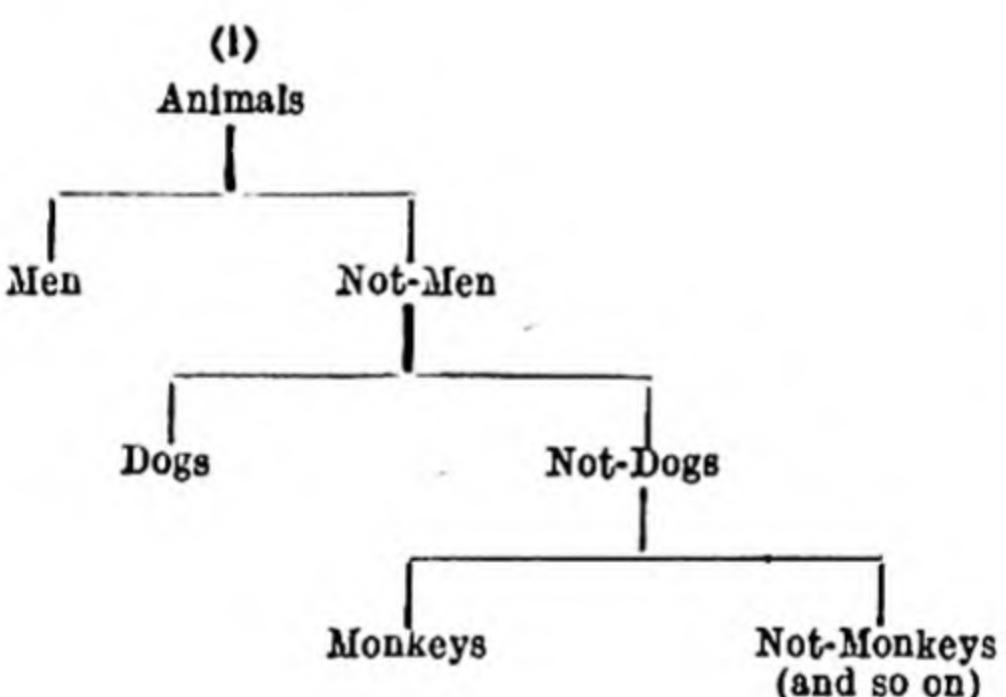
(2) The Division must be exhaustive.—The constituent species must be together equal to the genus. In other words, there must be a place for everything belonging to the genus in one or other of the species into which it is divided. Division being the analysis of a genus into its species, it is obvious that all the species included in the genus must be mentioned; otherwise the analysis is not complete. But as it is not always possible to know all the species of a genus, we generally add the words "and the rest" or "etc." after mentioning all the sub-classes known, to ensure the observance of this rule. If our knowledge were complete, the addition of this phrase will not be required.

The violation of this rule makes the division either too narrow, when we have only divided a part of the genus and not the whole of it; or too wide, when it also precludes species not actually part of the genus. In a true division the sum of the constituent species must coincide with the whole genus. If it does not, the division is either not exhaustive or is redundant.

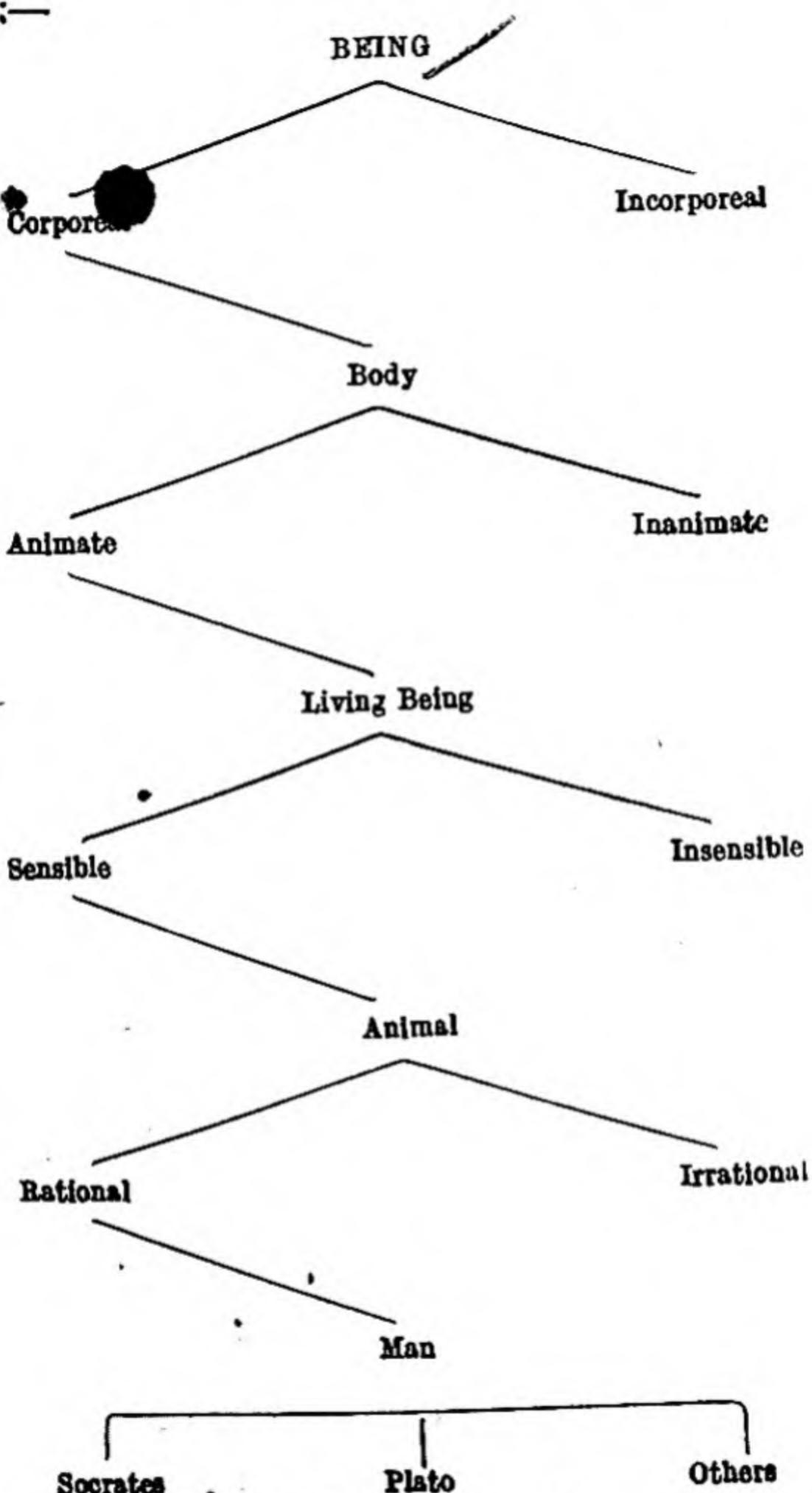
(3) The constituent species must be mutually exclusive, i.e., no individual must find a place under more than one of them. If the first rule is followed, this condition will also be fulfilled, since as long as we adhere to one *fundamentum divisionis*, the species will necessarily be exclusive of each other. Thus, if we divide 'men' into philosophers, historians, mathematicians, Indians, Persians, etc., we evidently violate this rule, since the species are not mutually

exclusive. This rule is, therefore, easily broken by a cross-division.

5. Dichotomy.—This is a form of division which is necessarily exhaustive. The word literally means 'cutting in two' and Division by Dichotomy is the process by which a genus is divided at every stage into two classes which of necessity exclude each other and which respectively do and do not possess the same differentia. For instance, the following divisions are dichotomous :—



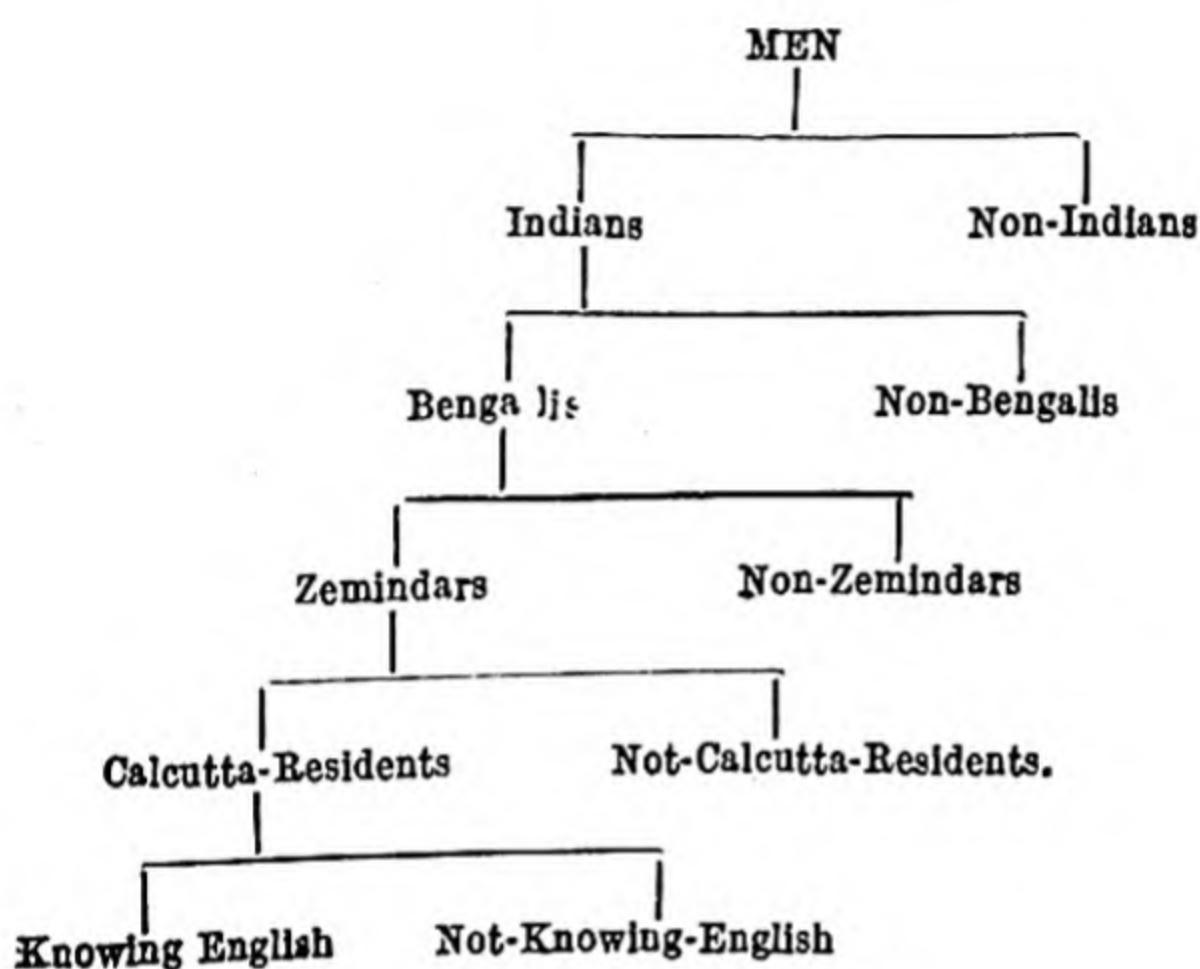
The same is illustrated by Porphyry's Tree as follows :—



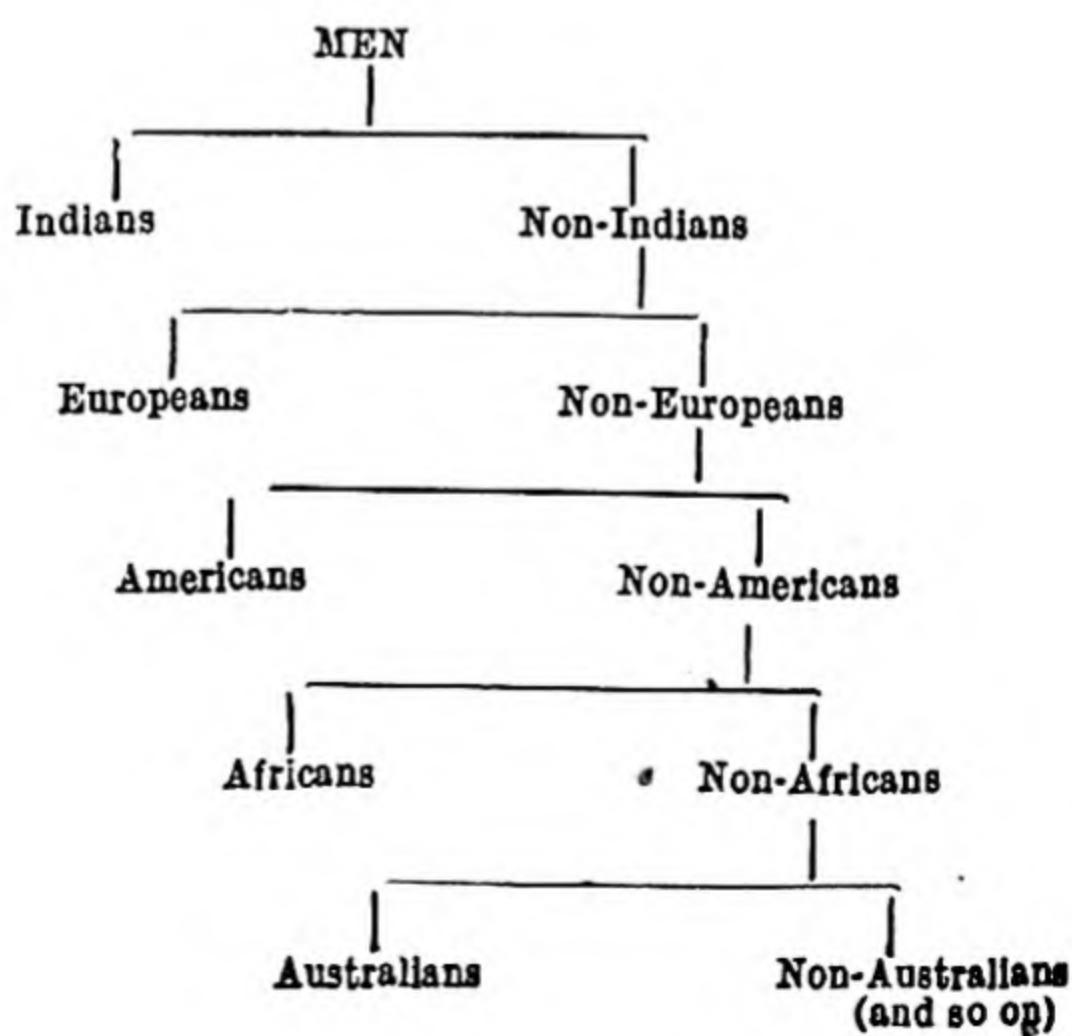
In this Division 'Being' is the summum genus; 'man' the *infima species*; 'Body,' 'Living Being' and 'Animal' are *subaltern genera*.

The following is a further illustration of Dichotomy :—

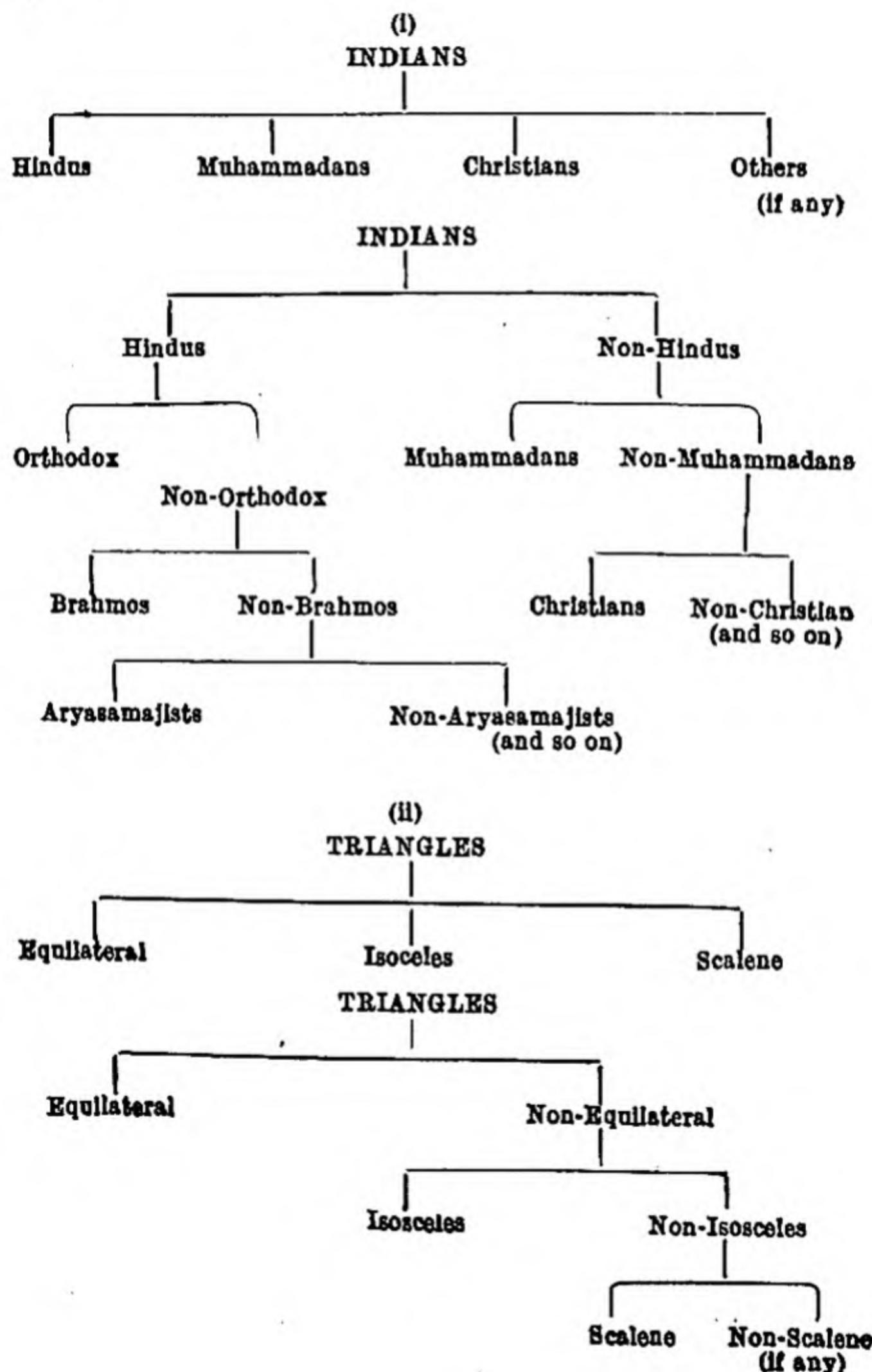
(i)

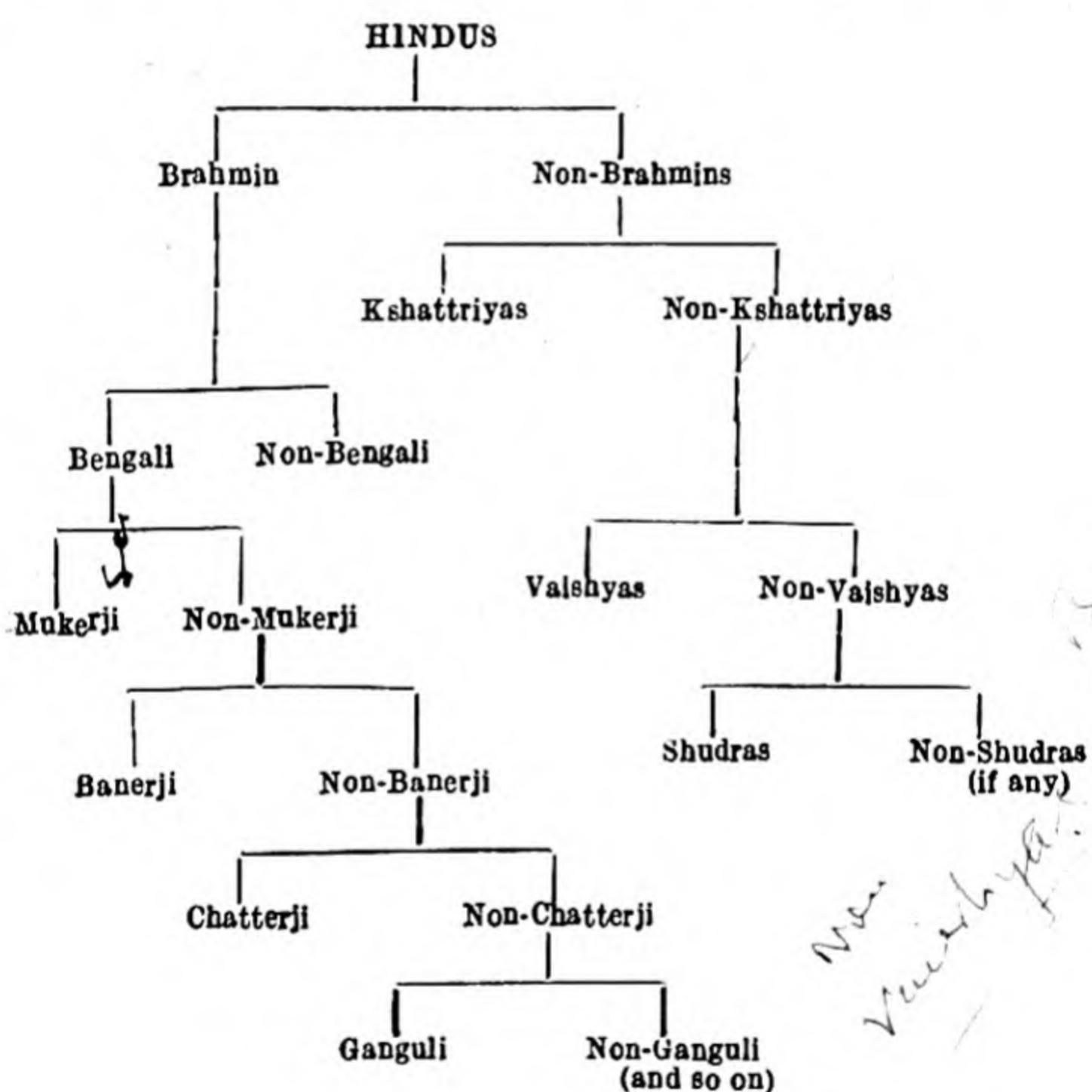
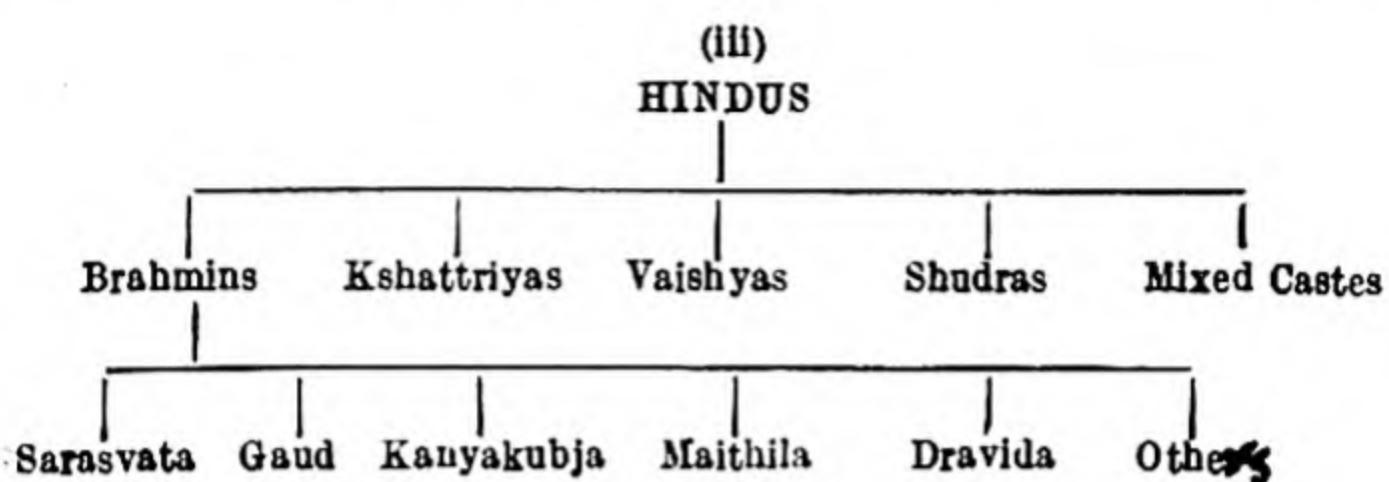


(ii)



A glance at the following schemes will bring out the comparison between the Proper Division and Dichotomy:—





We may now proceed to point out the relative merits and demerits of Division by Dichotomy. Formal Logicians claim that Dichotomy ensures the exhaustiveness of division. But this statement is questioned by Dr. Schiller, who remarks: "It does not

secure exhaustiveness. For there is no formal way of making sure that the class at which division stops, say not-B-not-C-not-D, does in fact=0. The Dichotomist never gets a formal signal to tell him when to stop, and may exhaust his ingenuity in suggesting *fundamenta*, but never his subject." (p. 77). But this criticism is a little too severe on the formal logician. If we take the negative or the indefinite term, like *not-x*, to mean 'everything *minus x*,' and proceed with our sub-division in the same way, then surely our division is *exhaustive*. It has nothing to do, from this standpoint, with the question whether there is anything real corresponding to the notion *not-x*, but in so far as *x* and *not-x* exhaust the whole universe, Dichotomy is necessarily exhaustive—formally. In fact that is the only purpose with which it starts, and if even that much is not recognised, it becomes absolutely useless.

Its use lies in analysing some one subordinate species and also in testing whether a division which is not dichotomous is exhaustive or not.

The following are, however, the defects of Division by Dichotomy :—

- (a) Each act of division gives us a *negative* sub-class, which is again similarly divided into two sub-classes. But a negative conception, like 'not-A,' cannot really furnish a proper basis for further sub-division. Yet it is just what Dichotomy attempts.
- (b) It places co-ordinate species in a wrong place.
"Proper division co-ordinates concepts

of the same degree of speciality ; but the division by Dichotomy subordinates them in several stages."

- (c) Its negative terms are hypothetical. If they contain many different species known to us, Dichotomy misleads us into the supposition that they have a generic unity ; on the other hand, if we are not aware of the species covered by the negative terms, we are evidently introducing sub-classes whose very existence is doubtful, and in this way Dichotomy can be carried on to any length.
- (d) It is too cumbrous. This is evident from a comparison of the two modes of division e.g., of triangles (see above). The order in which it places the *subaltern genera* is quite arbitrary.
- (e) It does not proceed on a single *fundamentum divisionis*. It usually adopts a different basis at each step, and one which is, as a rule, arbitrary.

6. **Classification.**—It is the systematic arrangement of materials into classes mainly for purposes of scientific advancement. Scientific classification is "a series of Divisions, so arranged as best to facilitate the complete and separate study of the several groups which are the result of the divisions, as well as of the entire subject under investigation." It is based on the principles of logical division. It must find its material

in the world and apply to such material the formal principles of division. An unconnected mass of bewildering materials is reduced to order and system by its classification into groups containing like things of one order and others of another order, and so on. It cannot therefore use Dichotomy. Thus, Classification may be distinguished from Division :—

- (a) In Classification, we start with the particulars of a genus, and throw them into groups, according to their resemblances and differences ; while, in Division, we start with the genus, and distinguish its species by the differential of which the genus is susceptible.
- (b) Classification moves upwards from the more special to the more general. Division moves downwards from the more general to the more special.

7. **Hints on the Testing of Divisions.**—The first thing is to know whether the division is logical or non-logical, and if the latter, whether it is physical or metaphysical or whether it is merely a verbal distinction. If it is logical, whether it fulfils the three conditions laid down under "Rules," and this can be easily determined by the following test questions :—

- (i) Is there only one *fundamentum divisionis* and is it appropriate ?
- (ii) Is the division exhaustive ?
- (iii) Is the division exclusive ? If not, find out where the species overlap and determine

the causes (*fundamenta divisionis*) which lead to cross-division, or (b) careless definition or (c) species not being cognate.

Let us now work out the following typical examples in order to show how divisions are to be tested :

(1) 'Eggs' into the white, the yolk, the skin and the shell :

This is not a logical division but only a physical one or a partition, as it only names the different parts of which an egg is composed.

(2) 'Books' into quarto, folio, scientific, and historical.

It is a logical division no doubt, but is faulty inasmuch as it violates our Rule (3) and is in fact a cross-division, due to a confusion of the *fundamenta*. The classes 'quarto' and 'folio' are unnecessarily confused with 'scientific' and 'historical.' Moreover, the conjunctive 'and' (instead of the disjunctive 'or') is out of place in a division that in no way pretends to be exhaustive.

(3) 'Man' into timid or rash.

The *fundamentum* is obviously 'behaviour with regard to danger.' The division is logical but faulty because it is not exhaustive. One may be neither timid nor rash but cautious. Hence the division should be 'timid, cautious, rash.'

(4) 'Great Britain' into England, Scotland and Wales.

This is only physical division.

(5) 'Milk' into sweet, sour, etc.

This is an incomplete metaphysical division.

(6) 'Mind' into knowing, feeling and willing. This is metaphysical division.

(7) 'Men' into white, black, educated, intelligent and dull.

This has more than one *fundamentum divisionis* and is also incomplete.

~~DEFINITION~~ SUMMARY.

~~Division~~ is an analysis of the denotation or extension of a term, while **Definition** is that of its connotation or intension.

The genus which is divided is called the *totum divisum*; the species into which it is split up are known as *membra dividentia*; and the basis on which an act of division proceeds is called the *fundamentum divisionis*.

The difficulties of a logical division are the determination of an appropriate *fundamentum* and the securing of exhaustiveness in the process.

Logical Division proceeds as far as possible on formal grounds but a reference to 'material' knowledge cannot be avoided. To ensure the exhaustiveness of division formal logicians propose **Dichotomy**, which cuts up a genus into a positive and a negative term at each step.

But although useful in testing the validity of a division and in analysing some one species, **Dichotomy**

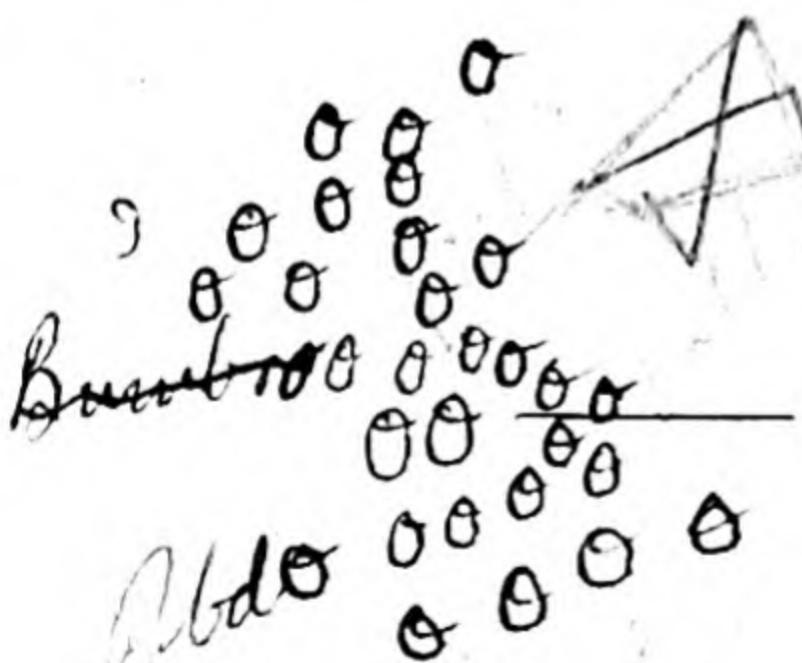
is open to serious defects, viz.—

- (i) Its negative sub-classes are always hypothetical and furnish no real basis for further sub-division.
- (ii) It misplaces co-ordinate species.
- (iii) It is too cumbrous.
- (iv) It does not proceed on a single *fundamentum*.

~~Rules of Logical Division—~~

- (1) Each act of Division must be conducted on a single basis.
- (2) The Division must be exhaustive.
- (3) The constituent species must be mutually exclusive.

Classification is a systematic grouping of materials on the basis of resemblances and differences, and usually moves upwards from the more special to the more general. Scientific classification must also stand the test of formal validity.



Very good book for those students
are reading Philo
Book II.

PROPOSITIONS

CHAPTER I.

NATURE OF JUDGMENT.

1. Judgment, Proposition and Sentence.—We have defined Logic as the science of Right thinking and the simplest piece of actual thought is the judgment. Logic is, therefore, strictly speaking, the scientific study of Judgment.* This idea has been better understood since Hegel repudiated the alternatives in the field of Logic by reducing Deductive and Inductive Logic to mere raw material for the reconstruction of *organic logic*, as we have, for instance, in Sigwart, Bradley and others. We shall speak of it in the following section on the true nature of judgment.

Judgment is a purely mental act, and it can only become available for Logic when expressed in language in the form of Proposition. For logical purposes therefore the terms Judgment and Proposition are interchangeable, and their distinction is without a difference.† We can no doubt think, without the aid of

* e.g. B. Erdmann holds that Logic is mainly concerned with an inquiry into the nature of Judgment.

† English logicians, as a rule, prefer to speak of 'Proposition,' while Continental logicians of 'Judgment.' "Proposition is a word to avoid, on account of the confused way in which it has always been traditionally used. It ignores the distinction between *assertion* and *statement*" (A. Sidgwick, *op. cit.* p. 227).

words, and so a judgment can exist without its verbal expression. But until our thought assumes the fixed form expressed in a proposition, logic can have no interest in it. It is for psychology to analyse the mental process of judgment, but Logic is concerned only with judgment as a finished product with a fixed significance : and then it should of course be expressed in the form of a Proposition.

But a proposition should, on the other hand, be carefully distinguished from a sentence. The sentence is the grammatical unit of thought, the unit of speech ; and it is quite satisfactory to see modern educationists pointing out the mistake of beginning the study of a foreign language with mere *words* instead of *sentences*. Logic is concerned with propositions and Grammar with sentences. The logician analyses the proposition into two terms, the subject and the predicate (connected by the copula), and the grammarian analyses the sentence into two or *more* words. We must remember that all propositions are sentences ; but not all sentences are propositions. A Judgment expressed in words is a Proposition, and a Proposition is only *one* kind of sentence. A command, wish, exclamation, or question is a sentence but not a proposition. All sentences, about which you can ask 'Are they true or false,' are propositions. A proposition is, then, a sentence which expresses truth or falsity : in other words a proposition always makes an *assertion* :* it is an *indicative* sentence.

* An "assertion" is the meaning of a judgment (or a thought), and a "statement" is its verbal expression.

2. Judgment as a compound: *criticised*.—Since Aristotle defined Judgment as “a synthesis of concepts as though they were one,”* logicians have fallen into the error of viewing Judgment as a compound of *two* ideas. But elsewhere† Aristotle has taken the correct view also while defining a Term as “the element into which a proposition is broken up, such as subject and predicate.” The false view which has been current till recent times regards judgment as composed of *two*, the subject standing for one idea, and the predicate for the other, and a judgment being simply the subsequent synthesis of the two ideas. According to this view, terms convey complete ideas and exist as independent units of thought. Under the same mistaken notion the grammarian analyses speech into words known as “Parts of Speech,” nouns, verbs, adjectives, adverbs and the like, and treats them as independent realities. But we are not unaware of the correct view according to which the classification of words into ‘parts of speech’ is entirely relative to the function of the words in a sentence; and, as Dr. Bosanquet puts it, “they are studied separately for convenience in attending to them, as we may study the wheels and pistons of an engine; but the work which gives them their names can only be done when they are together”.‡ The unit of thought must have a complete *meaning*, which can only be expressed in the simplest form in a

* *De Interpret*, Ch. I.

† *Anal. prior*, 24b, 16.

‡ Bosanquet, *Essentials of Logic*, p. 85.

judgment. Rightly observes Dr. Schiller, "If the simplest act of thought is the assumption of a meaning-attitude and the existence of meaning is therefore the ultimate fact for Logic, it follows that nothing more elementary can be found out of which judgments may be composed." (p. 93).

This will be further clear from the next section.

3. Judgment asserts one idea.—The erroneous view of judgment as a compound prevailed in Europe until Hegel laid down that the process of knowing could not be described as analysis or synthesis, but as a system or the manifestation of a unity in difference. The application of this idea to logic by the modern neo-Hegelians brought forth results which transformed the theory of Judgment then current. Hegel denied—

- (i) that there are separate ideas ;
- (ii) that we join those ideas ;
- (iii) that we seek real identity ;
- (iv) that we assert mere difference.

At the same time he asserted that—

- (i) We begin with system and then articulate it.
- (ii) Judgment is a process by which the subject articulates itself ; a process by which the unity and the difference are maintained.

Whatever we may have to say in regard to the arbitrary nature of Hegel's method and the pretensions of his doctrine, it goes without saying that the chief significance of his philosophical contribution lies, *first* in his advocacy of the spirit of reconciliation of opposites ;

secondly in his idea that there is only one thing (*viz.*, spirit) that fulfils the condition of organism—which is a system of systems; and *lastly* in maintaining that distinctions are useful but divisions and separations are fatal. Modern logic owes much to Hegel's contributions. The following is, from his standpoint, the simplest statement about the nature of Judgment:—

Any complete act of thought is a judgment and is expressed in a proposition.

Proof (1). Take up any book, open it at any page and you will find that it contains nothing but sentences, each of which expresses *one* idea, which is more or less complex. The subject and the predicate each do not give an idea but only a fragment. Judgment is already a one in the many—a system.

*Proof (2).** Any single word is a compressed sentence, *e.g.*, when we speak out "Wolf," we convey some such idea as 'the wolf is worrying the sheep,' or 'the wolf is eating a lamb,' or the like. Mr. Bradley observes: Any content whatever which the mind takes as a whole, however large or however small, however simple or however complex, is one idea, and its manifold relations are embraced in a unity.

Proof (3). In a sentence each word does not stand for a complete thought but derives its character from the function it performs in a

* Cf. Bradley *op. cit.* p. 12.

sentence (system). In the sentences, 'I cut this page,' 'A cut apple,' and 'A cut of this piece of cloth,' the word 'cut' is a verb, an adjective and a noun, according to the function it performs.

This truth is now recognised by all modern logicians. Dr. Bosanquet* supports the statement by saying that the name or concept has no reality in living language or living thought, except when referred to its place in a proposition or judgment. We ought not to think of propositions as built up by putting words or names together, but of words or names as distinguished though not separable elements in propositions. For a detailed account of the nature of Judgment the student should consult the works of Bradley, Sigwart and Bosanquet. We shall close this section with an appropriate quotation from Mr. Bradley (p. 12): "It is not true that every judgment has two ideas. We may say on the contrary that all have but one. We take an ideal content, a complex totality of qualities and relations, and we then introduce divisions and distinctions, and we call these products separate ideas with relations between them. And this is quite unobjectionable. But what is objectionable, is our then proceeding to deny that the whole before our mind is a single idea; and it involves a serious error in principle. The relations between the ideas are themselves ideal. They are part of the meaning and not of the existence. And the whole in which they subsist is ideal and so one idea." He

* *op. cit.* p. 87.

adds further (p. 13): "But these various elements, though you are right to distinguish them, have no validity outside the whole content. . . . 'Whatever is fixed by the mind as one, however simple or complex, is but one idea. But, if this is so, the old superstition that judgment is the coupling of a pair of ideas must be relinquished.'

4. Judgment as True-or-False.—Concepts or ideas cannot in themselves be true or false ; they are neutral. For instance, the ideas 'man,' 'giant,' 'sea,' 'dog,' are neither true nor false. Nor can a mere combination of words be true or false. It is only judgment that admits of truth or falsity. Falsity must be distinguished from falsehood. Falsehood includes a lie, and a lie is not an error or falsity of knowledge ; but, as Plato says, a lie is a "falsehood in words," while ignorance or error is a "falsehood in the mind." If a man utters a proposition and believes it to be false, then it is to him a falsehood ; but the nature of falsehood is a psychological and ethical question, while in logic we are only concerned with consistency and truth. A judgment therefore can be a truth or a falsity but not a falsehood ; and it is on this criterion that we can mark off the spheres of Logic and Psychology, and also distinguish judgments from concepts and "from such extra logical processes as questions, wishes, and commands," of which we have spoken above.

Nothing but a judgment can be true or false. As Prof. Welton observes*—We say sometimes "Nothing

* Welton, *Logical Bases of Education*, Macmillan, 1904, p. 71.

can be truer than fact," but by fact we do not mean simply an occurrence in the external world but such an occurrence as known ; *i.e.*, as judged. The occurrence simply *is* ; it is the judgment about it which is true or false.

Again, an idea may be real ('horse,' 'man,' etc.) or imaginary ('centaur,' 'sphinx'), but it cannot be *true* or *false* ; an inference may be valid or invalid, but not *true* or *false* ; it is only a Judgment that can be *true* or *false*.

SUMMARY.

The true unit of thought is a judgment, and a judgment expressed in words is a proposition, which is only *one* kind of sentence.

All propositions are sentences, but only those sentences that do not express wish or command or question are propositions.

The distinction between Judgment and Proposition is in logic a distinction without a difference. The two terms are used indiscriminately by logicians.

The superstition of old Logic that a judgment is a compound is now thoroughly exploded. Nothing more elementary can be found out of which a judgment may be composed.

The true view is to regard Judgment as the assertion of *one* idea. Concepts may be distinguished *within* judgment as its elements found on analysis, but such

elements have validity only *within* and *not outside* judgment. Whatever is fixed by the mind as one is but *one* idea.

The criterion of a judgment, as distinguished from concepts, words, combinations of words, inferences, etc., is that it is either *true* or *false*. Thus Judgment may be defined as a thought which can be qualified as true or false. It is essentially the assertion of a fact. If the fact is real, it is *true*; if the fact is not real or does not exist, the judgment is *false*.

Logic is concerned with truth and *falsity* of judgments and not with their *falsehood* (which includes a lie, etc.).

Nothing but a judgment can be true or false.

CHAPTER II.

IMPORT OF PROPOSITIONS.

1. **Relation of Subject and Predicate.**—The *import* of propositions means their interpretation in reference to the relation between the subject and the predicate. In order to bring out such relation we must first of all state the import of the subject and the predicate severally. Two theories are to be distinguished:—

- (i) That a judgment consists in putting two *ideas* (concepts or notions) together (*cf.* Hamilton*). A judgment is a recognition in thought, a proposition, a statement in words, that one notion is or is not, part of another.
- (ii) That a judgment consists in comparing two *things* (*cf.* Jevons†, Mill‡). In criticising Hamilton's theory of Judgment Mill remarks that on that theory there is no reference to objective reality which is the true mark of a judgment. We judge about *facts*, not about *concepts*.

The first theory implies that each of the two ideas is a whole by itself and in judgment we pass from one to the other. Thus logical connection is confused with mental transition. But the parts of a judgment are

* Hamilton, *Lectures on Logic*, p. 227.

† Jevons, *Elementary Lessons in Logic*, p. 61.

‡ Mill, *Logic*, Bk. I., Ch. 3—5.

not units by themselves and do not succeed one another like the parts of a sentence. A judgment is *one* continuous mental state and within it we distinguish its parts, which are therefore mere abstractions in logic. Moreover, if it consists in a transition from one to the other *idea*, there cannot be any reference to reality ; hence from that point of view it cannot be a judgment at all, inasmuch as it makes no *assertion* with reference to actual facts. That the judgment correlates ideas is, however, true only as a truism, inasmuch as ideas are the meanings of our words and embody our past experiences and serve as instruments of fresh thinking.

The other theory, *viz.*, that a judgment refers to *things*, not to *ideas*, cannot however be supported on any psychological basis, since *things* cannot enter the mind, and however we might speak of them, we *know* them only through ideas or as ideas. Intellectually, therefore, our world of the so-called *things* is nothing but a world of *ideas*. Logically, however, this theory is more cogent : Mill rightly says that our aim is to affirm about matters-of-fact, not about ideas.* The purpose of ideas is to operate on reality ; it is after all from experience that we learn truth. The general purpose of Judgment is to manipulate experience, and, as

* According to Bradley, if judgment is the synthesis of two *ideas*, then truth consists in the junction of unreal, and will refer to fact only *indirectly*. Thus judgment will be all hypothetical. But, as a matter of fact, judgment is not confined to ideas but refers to *present reality*, though it does not refer to reality as present. (*op. cit.*, Bk. I, Ch. II).

the Pragmatists would say, the validity of any judgment depends on its success in so doing.

The more important aspect of this question is whether there are *two* things that are compared in a judgment. That is what Jevons maintains. He takes the subject-word to stand for one thing and the predicate-word for a second thing, and these two are joined together by a copula. The two separate things are more or less like two railway carriages, which are linked together by means of the connecting hook-and-screw. So, on this theory, the copula links up the subject and predicate, which correspond to *two* separate things or groups of things. Now, this theory appears quite unsound if viewed in the light of our remarks on the nature of judgment. A judgment, we repeat, is one complete idea, within which we may further distinguish the elements called Subject and Predicate.

Now we come to the second point, *viz.*, the interpretation of Propositions. We know that each term of a proposition can be understood in extension or intension. Hence a proposition may be interpreted in the following four ways, which are known as **Theories of Predication** :—

- (1) When both the subject and the predicate are taken in extension (denotation). This is known as the **Class Theory of predication**.
- (2) When both the subject and the predicate are taken in intension (connotation). This is known in Formal Logic as the **Attributive Theory** or **Connotative Theory**.

(3) When the subject is taken in extension and the predicate in intension ; i.e., when the proposition expresses a relation of substance and attribute. This is called the Inhesion Theory, as the attribute is supposed to *inhere* in the subject.

(4) When the subject is taken in intension, the predicate in extension.

Thus the proposition "Man is rational" may be interpreted in these four types as follows :—

- (i) That the class 'man' is included in the class 'rational.'
- (ii) That the attribute of 'rationality' is implied in the attributes of 'humanity.'
- (iii) That 'men' have the attribute of 'rationality.'
- (iv) That the attributes of 'humanity' imply an object belonging to the class 'rational.'

The last seems rather an unnatural way of expressing our meaning ; yet it must be taken into account as it is no less a logical possibility.

This logical classification of the possible meanings of a judgment does not quite agree with the psychology of judgment. In actual thinking we may sometimes unite two or more of these aspects together, and may also make room for different interpretations of one judgment ; hence the *exclusiveness* of these four types does not necessarily find a support in psychology. Further, as Dr. Schiller observes, sarcasms and jokes

often mean the very opposite of the literal sense, and logic does not mention any type under which such judgment could be placed. But on the whole, we must admit that the logical classification sketched above is useful and valid. The types mentioned represent the usual ways in which we interpret a judgment, and it is in no way difficult to fix up a fifth type to cover sarcasms, jokes, etc. The third type is, however, the most common way in which we formulate our meaning in a judgment. Venn and Bosanquet are thus right in holding that the Subject is naturally taken *more* in extension, and the Predicate *more* in intension.

2. Logical Subject distinguished from Grammatical.—We have already seen that the two elements of a logical judgment are called the Subject and the Predicate. Grammar also makes use of the same terms, but the logical subject should be carefully distinguished from the grammatical subject. Take the sentence “Heat expands bodies.” Here the grammatical subject is “heat,” and the predicate is “expands bodies.” But if this sentence is treated as a logical proposition, the subject is not necessarily identical with the grammatical subject. It is determined by the purpose answered by the whole assertion. This proposition may be an answer to the query, ‘What expands bodies?’ or ‘What do you know of heat?’ In the first case ‘heat’ will be the logical subject, in the latter ‘expanding bodies.’ By the logical Subject is meant “that part of the experience interpreted from which the thought starts; and by the logical Predicate is meant that further

movement of thought which makes the experience more explicit." Grammatical subject is only the nominative to the principal verb in a sentence, and it cannot, in any proposition, be taken without further enquiry as the logical subject. However, as speech should express thought with the greatest possible exactness, judgments are most adequately represented by propositions in which there is this coincidence, so that, as Dr. Bosanquet puts it: "I think that to ask whether the grammatical corresponds to the logical subject is only to ask whether we have said what we meant to say."* The logical subject is the point from which the thought starts, and the logical predicate develops that thought still further.

3. Copula.—It is commonly held that a judgment is the synthesis of Subject and Predicate by means of the Copula "is." We have already pointed out how erroneous such a view of judgment is. Here we are concerned with the question as to the nature and function of the Copula, and the justification if any of regarding it as a third member of a judgment.

The common but erroneous notion about the copula is that it is a coupling-link between the subject and the predicate. This rests on the belief that the terms of a judgment can exist independently of their relation—a belief whose unsoundness has already been pointed out.

* Bosanquet, *Knowledge and Reality*, p. 183; Welton, *Logical Bases of Education*, p. 76. See also Joseph, *op. cit.* p. 150.

Words independent of their relation are not 'terms in the judgment' but *out of* the judgment. If the copula were to bring about a relation between the two terms of a judgment it would mean that they did exist as *terms* even prior to the relating act—which is absurd. As Mr. Boyce Gibson says, "The essential point to recognise, however, is that the term of a proposition exists only in the proposition itself as organically one with it, so that the Copula as relating activity, cannot be identified with any single partial element in the Judgement—with a relation, for instance, that is outside the terms. It must be the activity which brings terms and relations, content and form, not *together*—for this implies a previous separate existence in mutual isolation—but *into-birth-together*" (p. 125). Swinburne's representation of the copula as the link coupling the two railway carriages of subject and predicate cannot, therefore, be taken literally. It is rather a misrepresentation of the copula, and "is an excellent type of the way in which we should *not* think of it." As Prof. Bosanquet observes, we should think of it rather as the grip with which the parts of a single complex whole cohere with one another, differing according to the nature of the whole and the interdependence of its part. Benno Erdmann has strikingly expressed this point of view by saying, that in the judgment, "The dead ride fast," the Subject is "the dead," the Predicate "fast riding," and the Copula "the fast riding of the dead." In other words, the Copula is simply the judgment considered exclusively as a cohesion between parts of a complex idea, the individual

connection between which can only be indicated by supplying the idea of those parts themselves" (*op. cit.*, p. 100). The Copula cannot therefore be regarded as a third member of a judgment; it must be identified with the whole of the judgment, since a judgment is not such without the relation implied by the copula.

The **mark of the Copula** in a proposition is the verb "is," if the assertion is affirmative, and "is-not," if the assertion is negative. But in common speech this mark is not always found, although Formal Logic can twist any proposition in the strict logical form with the copula-mark. For instance, the proposition "it rains" does not contain the usual copula-mark "is." But it is at once changed into its logical expression "it is raining." But is not the meaning also changed in such transformation of verbal expression? Surely, to say that "he works" is not the same as "he is working;" so too "he sings" and "he is singing," "he plays on the harp" and "he is playing on the harp," "he thinks" and "he is thinking," are not the same in meaning. But the copula is present in either of the two types, whether it is expressed explicitly by "is" or not. Its function is, as Mr. Joseph points out (*op. cit.* p. 146), to express that the subject and predicate are brought into the unity of a judgment: that the predicate is asserted of the subject and that the subject is qualified by the predicate. . . In our thought the copula is the synthesis (or linking) of judgment: it is the form of the act, as distinguished from subject and predicate,

which are the matter.* In our language, the copula is a word used to express the performance of that act.†

A judgment being a purely mental act and the unit of thought, we cannot speak of its *parts* with any propriety, but we may do so in reference to a proposition which is its verbal expression, and from that standpoint the copula may be looked upon as a third and distinct member of a proposition, although the proposition expresses a single act of thought. A judgment contains no more than two terms: the Subject and the Predicate; the Copula only expresses their unity which already existed in the judgment.‡ The Copula is indeed omnipresent in the judgment.

4. Signs of Predication.—We have said above that the logical subject is the point from which our thought starts, and the predicate enlarges or modifies it further. Sigwart has pointed out that the movement of thought in a judgment is not the same for the speaker and his hearer. The former knows what he is going to say, and to him therefore a judgment is an act of analysis first and of synthesis in retrospect, while for the hearer the predicate is some new information, and therefore the judgment is for him an act of synthesis first and of

* The act of judgment consists in transforming the given matter into the relation of subject and predicate.

† The copula is only the substitute for the verbal form in predicates like adjectives and substantives which do not admit of conjugation—*Windelband*.

‡ See Sigwart, *Logic*, Sec. 5 (1) and Joseph, p. 152 note.

analysis in retrospect.* Keeping in view what we have already said on the unity of the judgment there is no harm in speaking of the copula as a mark that implies synthesis of subject and predicate in a proposition. Such synthesis is expressed in several ways, e.g., by the inflection of the verb, by the verb substantive, by the mathematical symbol of equality, and so on. The Copula is thus one of the signs of predication. The inflexion of the verb occurs more frequently in common speech than the verb "is", and the copula is then said to lurk in the inflected verb, and logicians extract it by changing the verbal form. But whatever sign of predication may be employed, the mathematical symbol for equality should never be employed in place of copula. Mr. Joseph rightly says: "The mathematical symbol of equality has a different meaning; it is not a sign of predication, but an incomplete predicate; it implies, of one thing, quantitative identity with some other" (p. 152). The usual form of the judgment is 'S is P,' which can be written in an abbreviated form as 'S P.' But it is quite incorrect to write it in the form 'S=P,' because it is equivalent to 'S is equal to P' in which the predicate is not 'P' as in the other form but 'equal to P.' If, therefore, = is to be adopted as a sign of predication, this proposition should be stated as the equation 'S=(is) equal to P' and not as the equation 'S=P.'

* "The necessity for the copula is a sheer superstition. Judgments can exist without any copula and with but one idea". Bradley, *op. cit.* p. 49:

5. Tense of Propositions.—Why should the copula be restricted to the present tense of the verb 'to be ?' On this question there has been a good deal of discussion among logicians. It is absolutely necessary that the past and the future tenses of the verb 'to be ' should be changed into the present tense in order to bring about the strictly logical form of a proposition, and in so doing is there no violation of the meaning ? Shall we say "The philosopher Spinoza died in 1677 " or "The philosopher Spinoza's death is an event of the year 1677 ?" Shall we say "Everybody will die " or "The death of everybody is a future event ?" Shall we say "Jack was found buried in a trench " or "Jack is a-person-who-was-found-buried-in-a-trench ?" Shall we say "A solar eclipse will take place next year " or "A solar eclipse is one of a class of things that will take place next year ?" It is obvious from these instances that in changing the forms of living thought in order to fit them into their logical schema, either the emphasis is shifted wrongly on to another word, which changes the meaning or the meaning is otherwise changed by an illusory reference to the past or the future. Some logicians hold that tense-modifications are part of the copula, while others hold that they are part of the predicate and not of the copula, which is restricted to the present tense only. There is no agreement on this point, but from a purely 'formal logic' point of view the latter opinion seems to be more valid in spite of the several objections that could be urged against it.

6. Modality of Propositions—Besides the tense-difficulty, there are other difficulties in connexion with the copula which are created by the distinctions of *modality*. By the *modality* of a proposition is meant the degree of certainty attached to the judgment expressed by it. Thus in the propositions 'S may be P,' 'S is P,' and 'S must be P,' the mode is expressed by 'may be,' 'is,' and 'must be,' and the names given to these judgments respectively are 'Problematic,' 'Assertoric' and 'Apodictic.' The first are true only under some circumstances and not under others, the second are true as far as experience goes, and the last are universally and necessarily true. Some logicians regard modal propositions as *compound*; e.g., 'S is probably P' is split up into (1) 'S is P,' and (2) 'That S is P is probable'; 'S cannot be P' is resolvable into (1) 'S is not P,' and (2) 'That S is not P is certain'; and 'S must be P' into (1) 'S is P' and (2) 'That S is P is necessarily true.'

The real question, however, is whether modality belongs to the copula or to the predicate or to the proposition as a whole. But on this no definite agreement among logicians has been arrived at. Mill holds that modality is attached to the copula, since what the modal propositions affirm is neither what the subject signifies nor what the predicate signifies, but specially and expressly what the predication signifies. Others consider it simpler and more consistent to attach modality to the predicate (*cf.* Fowler). In fact the subject of Modality falls outside the scope of Formal Logic, since it is

concerned entirely with the matter of propositions and not with their form. Yet it usually finds a place in Logic, partly because of its antiquity—as Aristotle himself considered distinctions of modality—and partly because it takes into account many verbal forms in actual use. Dr. Venn maintains that the subject can be properly discussed only in the Logic of Chance.

7. Negative Copula.—The usual marks of the copula are the expressions 'is' and 'is-not.' We know that the copula has a synthetic function of relating S and P; the relation being such as is not capable of being understood as distinct from the terms related. If so, it cannot divide; hence, Sigwart holds, there is no such thing as a *negative*, but only a *negated* Copula. But if we hold that there is always some kind of affirmation at the ground of a negation, and that we cannot deny an assertion without ourselves asserting, then the use of the expression *negative copula* is to be preferred to *negated copula*, which is reduced from this standpoint to a mere fiction.

On the question whether the negative particle 'not' should be attached to the copula or to the predicate, there is still a controversy among logicians, although the majority of thinkers have decided in favour of the copula.* The question is reduced to this: In the

* Hobbes does not recognise the *negative copula*, but only the *affirmative*, viz., 'is', 'are'. He would, in all cases, attach the negative particle 'not' to the predicate, in order to get rid of the distinction between affirmation and denial by treating every case of denial as the affirmation of a negative name.

judgment 'S is not P,' is 'not' to be connected with 'is' as 'S is-not P,' or with P as 'S is not-P'? Now, it is possible to turn every judgment of the form 'S is-not P' into 'S is not-P' unless 'not-P' is a positive concept. The meaning of the original judgment is to assert the exclusiveness of certain attributes and modes of being with reference to the subject. Such exclusiveness is a positive fact which is only ignored by the verbal transformation of 'S is-not P' into 'S is not-P.'* such a reduction is, moreover, contrary to the very spirit and mode of our actual thinking, as we do not think by negation in such an artificial manner ; and at the same time our language too cannot welcome such forms as 'not-P' which are more or less unnatural and illegitimate modes of expression. We are, therefore, inclined to support the view that the negative particle 'not' should not be taken with the predicate but with the copula : hence the copula has two marks, *viz.*, the affirmative *is* and the negative *is-not*.

8. Universe of Diction or Suppositio.—The copula, as we have already said, asserts a relation which is a positive fact, some kind of existence. It has also been said that a judgment must have reference to reality, explicitly or implicitly. There has been much discussion as to what kind of existence is implied by the Copula. Does it assert real existence, the real world of our ordinary experience, or does it refer to a special kind of existence, 'the existence in some other sphere of reality'? It is not necessary that the copula must always refer to

* See Joseph, *op. cit.* p. 167.

existence in our ordinary sphere of reality, for, we can speak of centaurs, sirens, muses, as if they were members of our actual world. But our propositions about them can have meaning only in the restricted spheres within which such mythical beings fall. Thus in the world of fable, centaurs may be said to exist ; they have therefore a special *universe of fiction or suppositio*. Outside this universe they are meaningless. Unless such a universe is definitely fixed to begin with, discussion may be unnecessarily prolonged in talking about the same things. As Dr. Schiller cogently remarks : “ The technical way Formal Logic has of making this very necessary distinction is to say that the Copula asserts existence within a *universe of fiction or suppositio*. Thus the truth or falsity of propositions about Sirens and Centaurs belongs to the realm of Greek mythology ; of propositions about Rebecca and the Templar depends on the text of *Ivanhoe* ; of propositions about unicorns and red lions on the conventions of heraldry and sign-painting ; of propositions about atoms and electrons on the speculations of physics. All these propositions have an intelligible sense in their proper universe, however mad they would sound otherwise.” (p. 108). Obviously the number of such universes of discourse is unlimited : every science, every business and every work of fiction will constitute a universe of its own ; and therefore no relevant discussion can go on until agreement is reached as to the *suppositio* referred to, which indicates, “ merely the restricted range to which the speaker at the time being intends his remarks to

apply." Dr. Keynes defines **Suppositio** as "the particular aspect or portion of the total system of reality referred to in any judgment." Thus illusions, dreams, hallucinations, fictions, etc., have each their own separate universe of fiction and the meaning of propositions cannot be understood except in reference to a *suppositio*.

SUMMARY.

The **Import** of Propositions means their interpretation in reference to the relation between the subject and the predicate.

Some logicians hold that the judgment correlates two *ideas*, and others that it correlates two *things*. The former position is true only in a general sense, inasmuch as ideas are the meanings of our words and embody our past experiences. On the other hand, as Mill holds, our aim is to affirm about matters-of-fact, not about ideas. The general purpose, however, of every judgment is to manipulate experience.

The subject and predicate are not to be viewed as two ideas or two things linked up by means of a third thing called the **Copula**. A judgment is a single and complete idea, and the copula is omnipresent in the judgment.

The theories on the relation of Subject and Predicate are called the **Theories of Predication**. The following are the principal ones :—

- (1) Both Subject and Predicate in *denotation*.
Thus, 'Man is mortal' means 'the class *man* is included in the class *mortal*.'
- (2) Both Subject and Predicate in *connotation*.
Thus, 'Man is mortal' means 'the attribute of *mortality* is implied in the attributes of *humanity*.'
- (3) Subject in *denotation*, and Predicate in *connotation*. Thus, 'Man is mortal' means '*men* have the attribute of *mortality*'.
- (4) Subject in *connotation*, and Predicate in *denotation*. Thus, 'Man is mortal' mean 'the attributes of *humanity* indicate an object belonging to the class *mortal*'.

The **Copula** is not a *third* member in the judgment. For two terms are not subject and predicate, except in the judgment; and the act of judging, whereby they become subject and predicate, is already taken into account in calling them subject and predicate; it ought not therefore to be reckoned over again in the copula. Its function is to express the synthesis of subject and predicate in a judgment. It is in the form 'is' or 'is-not.'

The mathematical symbol of equality is incorrect and misleading as a logical sign of prediction.

On the subject of tense and modality of propositions logicians are not at one. Some attach modality to the copula, others to the predicate.

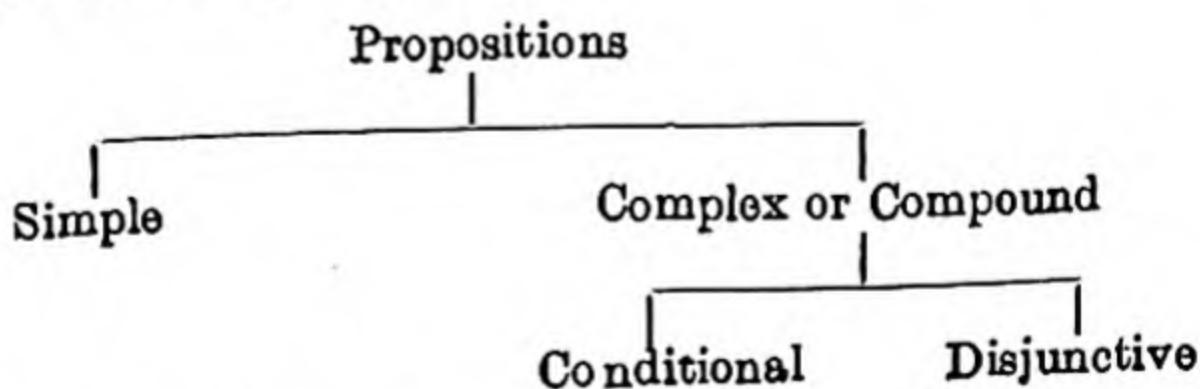
In the proposition 'S is not P' we must recognise the negative copula 'is-not' instead of connecting 'not' with the predicate as 'not-P.' The copula asserts existence in reference to a certain **Universe of Discourse** or **Suppositio**—the more or less limited sphere within which people tacitly understand their statements to apply.

CHAPTER III.

KINDS OF PROPOSITIONS.

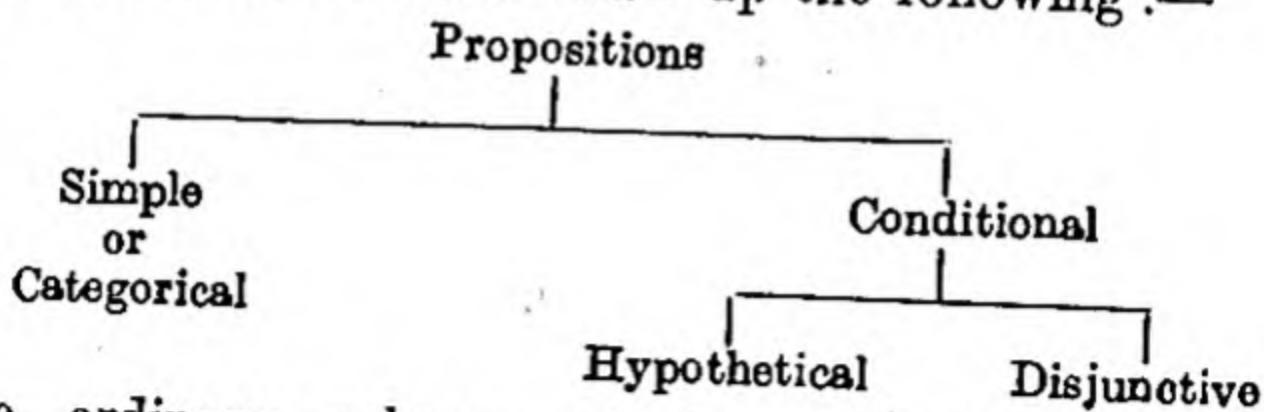
1. **General Classification.**—Propositions may be classified according to various principles. The division into Categorical, Hypothetical and Disjunctive, based on the *relation* between the terms is, however, the most important for Formal Logic, but before we consider these types we might as well briefly refer to other schemes of classification.

The division according to external form into *Simple*, *Compound* and *Complex* is not of much logical importance. A *Simple* proposition contains one subject and one predicate, e.g., 'Man is mortal,' 'The school is closed ;' a *Complex* proposition contains a subordinate clause entering into the subject or predicate, or both, e.g., 'This is the place where public lectures are delivered,' 'The man who called yesterday is now indisposed ;' and a *Compound* proposition contains more than one subject, or more than one predicate, or both, e.g., 'I came, I saw, and I conquered,' 'He and I are friends.' This classification is reduced to the following scheme by Bain :—

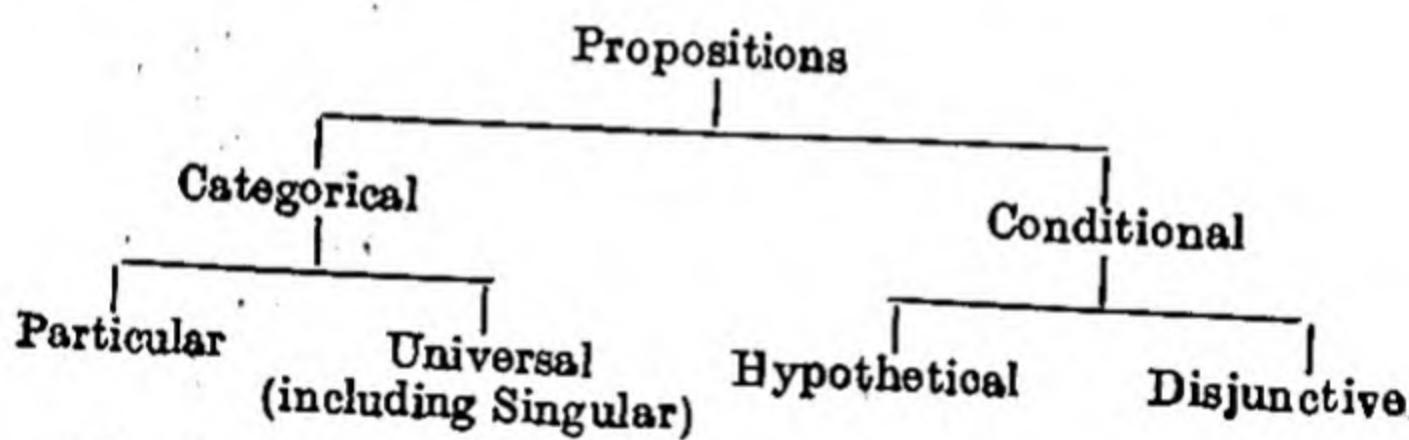


Mill has the same scheme, except that he uses the term 'Hypothetical' in place of Bain's 'Complex or Compound.'

Hamilton and Thomson draw up the following :—



The ordinary scheme, which met with the approval of several logicians in the last century, is thus represented in its entirety :—



The following defects of this scheme have been pointed out by Dr. Bosanquet* :—

- (i) It has no room for Impersonal and Demonstrative judgments (which, however, *might* be classed under the particular).
- (ii) Singular judgment, which is rightly classed as universal, is wrongly identified with the abstract universal.
- (iii) While treating of the universal judgment the Collective is not distinguished from the Generic.
- (iv) Hypothetical judgment is not *complex* or consisting of two categorical propositions (as is wrongly held by Bain and Jevons),

* *Op. cit.*, p. 114.

but it is a *simple* judgment, expressing a relation of reason and consequent.

(v) Analysis of the Disjunctive judgment, e.g., by Mill and Bain, is wrong. They divide it into *two* (but the *wrong* two) Hypothetical judgments. But the Disjunctive is more than any combination of Hypotheticals and tends to be Categorical: it cannot therefore be regarded as conditional.

Thus we see that in modern writers there is not a little confusion in logical nomenclature. It is better, therefore, to stick to the more ancient classification—which was adopted by Kant as well—based on differences in Quantity, Quality, Relation and Modality. The scheme is as follows:—

✓(1) According to *Quantity* :—

- ✓(i) **Universal** : e.g. 'All philosophers are wise.'
- ✓(ii) **Particular** : e.g. 'Some philosophers are wise.'

NOTE.—The third sub-division 'SINGULAR' (e.g., 'Plato is wise'), though recognised by Kant in his Transcendental Logic, as distinct from Universal, is taken no special notice of in Formal Logic.

✓(2) According to *Quality* :—

- (i) **Affirmative** : e.g. 'Some ladies smoke.'
- (ii) **Negative** : e.g. 'Some ladies do not smoke.'

NOTE.—The 'Indefinite' of Kant is treated by the way under the 'Negative' and is not recognised as a separate class in Formal Logic.

(3) According to *Relation* :—

- (i) **Categorical** ; e.g. 'The child is father to the man.'
- (ii) **Hypothetical** : e.g. 'If wishes were horses, then beggars would ride.'
- (iii) **Disjunctive** : e.g. 'You will either win or lose.'

NOTE.—Formal Logic recognises all these three sub-classes, and they affect its laws more particularly. They will, therefore, be more fully considered in this Chapter.

(4) According to *Modality* :—

- (i) **Assertoric** ; e.g. 'It rains.'
- (ii) **Problematic** : e.g. 'It may rain.'
- (iii) **Apodictic** : e.g. 'It must rain.'

NOTE.—Modality refers to the manner in which we think a judgment in regard to its truth ; hence some logicians exclude its discussion from Pure or Formal Logic.

Besides these, we shall distinguish the following classes as well :—

- (1) **Analytic and Synthetic.**
- (2) **Essential and Accidental.**
- (3) **Verbal and Real.**
- (4) **A priori and A posteriori.**
- (5) **Exclusive and Exceptive.**

2. **Forms of Quantity.**—The *Quantity* of a proposition is determined by the extension of the subject. A proposition is **Universal** when it refers to all of the individuals denoted by the subject ; in other words when it affirms or denies the predicate of the

subject *universally*, e.g., 'All men are faithless,' 'No crows are white.' A proposition is **Particular** when it refers to only some of the individuals denoted by the subject; in other words, when it affirms or denies that the predicate belongs only to a *part* of the subject, e.g., 'Some men are faithless,' 'Some students are not intelligent.' Thus a **Universal** proposition refers to the whole and a **Particular** proposition to a *part* (i.e. logical part) of a class.

When the subject of a proposition is a singular term, the proposition is called **Singular**, and this was distinguished by Kant from a **Universal** proposition. The subject of the former is completely determined, while that of the latter is unlimited with respect to its formal quantity. But in Formal Logic, the former ranks with the latter and is not set up as a separate class, since a singular term, denoting one individual, cannot refer to less than *all* that it denotes. Thus **Singular** propositions may be treated like **Universal** propositions. The mark of quantity prefixed to the former is '*some*',* to the latter '*all*' or '*no*' (*none*). Propositions without any mark of quantity are called **Indefinite**, e.g., 'Men are dishonest,' 'Women are jealous,' etc.: in such propositions the extension of the subject is left undetermined; thus 'men' might here mean '*all* men' or '*some* men,' so too, 'women' might refer to *all* or *some*. In such cases it is better to

* The rule in logic is that '*some*' in a particular proposition should always be interpreted as '*some, and possibly all*,' but not '*some, but not all*.'

take the subject to refer to 'some' and not to 'all,' and for this reason **Indefinite** propositions rank as **Particular**. They have really no place in Logic, until a sign of quantity is added to them. In some cases, however, they are treated as **Universal** * e.g., "Squares have four equal sides": here *all* and not *some* squares are meant.

Universal propositions should also be distinguished from **Enumerative** or **Collective** propositions which refer to a number of individuals only. This distinction is in a way based on the ambiguity in the terms *all* and *none*. For instance, if we say 'All rulers of that country are autocrats', it might be taken as a mere historical fact or a universal truth. To make the former sense more explicit the article *the* is sometimes prefixed, as 'All *the* rulers of that country are autocrats.' The **Enumerative** proposition is usually ranked with the **Singular**, although it indicates the possibility of passing from it to the **Universal** proposition. Mr. Joseph says: "The difference between a true universal judgment and one merely enumerative is exceedingly important. The one belongs to science, the other to chronicle or history. An universal judgment holds of any and every instance, alike past, present and future, examined or unexamined. An enumerative judgment holds only of those instances which we have examined and summed up in the subject.

* In cases where the *Indefinite* form stands for the class-nature and not for individuals, it is termed by some as **GENERIC** proposition.

All reformers are hated : if that is merely enumerative, it affords me no ground to anticipate hatred if I undertake reform ; it affords me no explanation of the hatred with which reformers have been met. But if it is a true universal, it explains the past and predicts the future.”*

Dr. Schiller criticises the classification of judgments into *universal* and *particular* by remarking that it is neither linguistically satisfactory, because it fails to deal with the actual *indefinite* propositions, nor logically satisfactory, inasmuch as the ‘universal’ forms have a plurality of meanings.

3. Forms of Quality.—In every proposition the predicate is either affirmed or denied of the subject. Thus on the basis of *Quality* we have **Affirmative** propositions, *i.e.*, those which affirm the predicate of the subject, and **Negative** propositions, which indicate a lack of agreement between the subject and the predicate. Besides these two forms which may be symbolised as ‘S is P’ and ‘S is not P,’ Kant mentions another type called the **Infinite**, such as ‘S is not-P.’† Formal Logic need not recognise this as a separate proposition, since it could be classed under the **Affirmative**. It may be that Kant recognised it as a separate judgment in order to keep up rigid consistency

* *Op. cit.*, p. 158. The distinction may also be brought out thus : We should interpret the *Enumerative* judgment in extension and the *Universal* judgment in intension.

† Read Bradley, *op. cit.* p. 111 (Sec. 5); also Joseph, *op. cit.* p. 163.

and uniformity in his scheme of judgments and categories.

There is some difficulty in regard to **Negative** propositions. At first they sound as a paradox: since judgment must always refer to the existent, the real—which is positive. But a negative proposition only tells us as to what a subject is not, how can it declare anything about it as it is? But unless it does so, it cannot be called a judgment. In other words the paradox is obvious from the fact that in a negative judgment the work of positive knowledge appears to be performed by ignorance! But the delusion that bare identities or differences are actually used in our thinking must be given up.* Neither of the two is a fact: in our actual thinking, *i.e.*, in judging, we are always interested in finding resemblances or in making distinctions. The selective activity of our thought is an undisputed fact. Thus it is true, as Hegel said, that judgment asserts an identity in difference, or a difference in identity, but it is perhaps still better to say with the Pragmatist that the **Affirmative** form 'S is P' means that we have so selected our 'S,' singling it out of a larger context, that P can be predicated of it and may for our purpose advantageously be identified with it. The **Negative** form 'S is not P' means that a purpose demands a distinction in a genus which for a different purpose might, of course, be irrelevant.

* "Bare denial amounts in strict sense to nothing. Identity and difference are inseparable aspects of all that exists or can be thought. Pure tautology aims at mere identity, and bare negation at mere difference."—Bosanquet.

The above paradox, according to which *negative* judgments could not be *judgments* at all, may thus be met. It is true that every judgment has a truth-claim, a reference to fact; and the *negative* judgment also refers to some *positive* fact as its ground.* Mr. Bradley says: “Every negation must have a ground, and this ground is positive. It is that quality *x* in the subject which is incompatible with the suggested idea. A is not B because A is such that, if it were B, it would cease to be itself. Its quality would be altered if it accepted B; and it is by virtue of this quality, which B would destroy, that A maintains itself and rejects the suggestion” (p. 112). And further, as Mr. Joseph observes (p. 162), the reciprocal exclusiveness of certain attributes and modes of being is the real truth underlying negation. But for that everything would be everything else; that is as positive, as these several modes of being themselves.

Dr. Bosanquet also says that reality is a *system* and we cannot have a system apart from negation.† Both affirmation and negation are equally necessary for it. Psychologically, affirmation is prior to negation in the earlier stages of our knowledge, but later on with

* On this point we agree, on the whole, with Sigwart, Erdmann, Bradley, and Joseph.

† “Negation always involves contradiction between contraries and not merely contrariety.” “What we mean in denial is always the contrary, something positive; what we say in denial—i.e., the literal form which we use—always approaches the contradictory, i.e., is pure exclusion.” This statement of Dr. Bosanquet is very significant; cf. his *Logic*, I, Ch. vii.

the evolution of thought negation assumes more and more importance till it becomes equivalent to affirmation. Negation is thus more 'subjective' than affirmation. Logically, however, as we have already said, negation is grounded in affirmation—and it is also true that every affirmation implies negation, inasmuch as affirmation means determination, limitation or selection (which implies rejection), hence denial as well. From this standpoint the aptness of Spinoza's formula "*Determinatio est negatio*" is also evident. Negation is, according to Dr. Schiller, the great instrument for expressing rejections for human purposes. In defining 'A' negations of a *finite* number must always suffice; for if the 'not A' were conceived as infinite, negation could never fulfil its purpose of defining the 'A' we have made an object of our thought. Negation is thus a *subjective* device of thought.

4. Forms of Relation.—Propositions are distinguished, according to their relation, into **Categorical**, those that merely affirm or deny a predicate of a subject, **Hypothetical**, those that do so under a condition, which, however, need not necessarily be fulfilled, and **Disjunctive** those that affirm alternatives. Examples of the first kind are:—'The War still continues,' 'The Earth moves round the Sun,' 'Metals are heavy'; those of the second kind are:—'If a country is well governed its people are happy,' 'If it rains the weather will be pleasant'; those of the third kind are:—'His conduct is either good or bad,' 'Either there is a future life or wickedness remains unpunished,' 'He is either

timid or modest.' The Hypothetical proposition is sometimes known as **Conjunctive**, since it conjoins the truth of the consequent with that of the antecedent, while the **Disjunctive** disjoins the two alternatives.*

The Categorical proposition contains a direct reference to reality in so far as it deals with facts of our experience: its assertion (affirmation or denial) is *absolute* and *unconditional*. The Hypothetical form has no reference to concrete reality as such; it is more of an abstract character; the relation it asserts must not necessarily be realised in our experience. It only implies that if a certain condition is present a certain consequence will follow: it makes an assertion about an abstract content. The Disjunctive proposition makes an assertion with an alternative.

The following are the main types of the three propositions:—

Categorical: 'S is P' 'S is not P.'

Hypothetical: 'If A is, B is;' 'If A is B, then C is D;' 'If A is B, then it is C.'

Disjunctive: 'Either A is B or C is D, or E is F.' 'A is either B or C.'

From an examination of these types we learn that their elements are not the same. The student will note that the symbols S and P have been used here only in the case of the Categorical proposition, while

* For an alternative scheme of classification see Coffey, *Science of Logic* (Longmans) Vol. I, p. 168 and p. 169 notes. We stick to this triple division, out of consistency and convenience.

A, B, C, etc., have been used in the other two cases. This fact is not without significance. The elements of the Categorical proposition are, in their verbal form, called terms : **S** standing for the Subject-Term and **P** for the Predicate-Term. Thus—

(Mercury) is (the heaviest metal).

S **P**

(Only short wars) are (popular)

S **P**

It is (sad) (to be wise after the event).

P **S**

But the elements of the other two types of propositions are not *terms* but *propositions* (or *clauses*). In the Hypothetical proposition, the clauses are related to each other as *Antecedent* (represented by the 'if' clause) and *Consequent* ; while in the Disjunctive proposition they are *Alternatives*. In both these types, therefore, their relation is not that of Subject and Predicate.

Thus :—

Hypothetical :—

(If it rains) (we shall have no cricket).

antecedent *consequent.*

(If you succeed) (you will be happy).

antecedent *consequent.*

Disjunctive :—

(Either the earth moves) or (the Sun moves).

alternative *alternative.*

Now we proceed to the treatment of each of the three types of propositions :—

(1) **The Categorical Proposition.**—All that need be said here on the nature of this type and of its distinctions as to Quantity and Quality has already been taken up in the last Chapter and in some of the foregone sections of this Chapter. The student should here revise those portions : the analysis of a Categorical proposition, the relation of the Subject and the Predicate, the meaning and function of the copula, the distinctions of Categorical propositions as to Quantity and Quality, and the meaning of negation in particular.

(2) **The Hypothetical Proposition.**—We have already spoken of the general nature of this type. Its content is composed of two relative proposition so related to each other, that if one is *so*, the other must be *so*. The proposition containing the condition expressed by some such word as ('if') is called the **Antecedent** or **PROTASIS**, while that containing the result is called the **Consequent** or **APODOSIS**. Such a relation excludes the mere coincidence in fact. The one proposition must be the *ground* on the basis of which the truth of the other statement is determined.

The following are the three forms in which the Hypothetical position could be stated :—

- (i) 'If A is, B is.'
- (ii) 'If A is B, then C is D.'
- (iii) 'If A is B, then it is C.'

Of these *the third form is the most expressive* and indicates the true import of the Hypothetical proposition. The first form is an abbreviation of the second or the third form. The second form, although “a broken-backed sequence,” is most commonly used: this form contains four terms and can, as a rule, be reduced to the third form.* For instance, without affecting the meaning, the proposition ‘If the barometer falls suddenly, we have a storm’ is reducible to ‘If the state of atmosphere causes a sudden fall of the barometer, it brings a storm.’ ‘If the government of a country is good, the people are happy and prosperous’ is reducible to ‘If the people of a country are well-governed, they are happy and prosperous.’

A Hypothetical proposition may be true, even though its realisation were impossible. Neither antecedent nor consequent may be realised. For example, ‘If Chaucer were alive to-day, he would not be able to understand modern English,’ ‘If you had remained silent, your ignorance would not have been detected. We know that the condition in each case could not be fulfilled, and consequently the result also could not be realised. But all the same the proposition performs its legitimate function, which is, to assert that if certain conditions were fulfilled something would exist. But, it may be asked, as judgment must have a reference to reality in order to be true, the Hypothetical

* On such reduction, refer to Welton, *Manual of Logic*, vol. I, p. 181.

judgment also, if it claims to be true, must refer to some real content; and as reality is actual, it follows that this judgment must also affirm something actual. But that it does not. This is the chief difficulty in the interpretation of the Hypothetical proposition.

On this character of the Hypothetical judgment Mr. F. H. Bradley says: "What is affirmed is the mere ground of the connection; not the actual existing behaviour of the real, but a latent quality of its disposition, a quality which has appeared in the experiment but the existence of which does not depend on that experiment. "If you had not destroyed our barometer, it would now forewarn us." In this judgment we assert the existence in reality of such circumstances, and such a general law of nature, as would, if we suppose some conditions present, produce a certain result. But assuredly those conditions and their result are not predicated, nor do we even hint that they are real. They themselves and their conditions are both impossible."* Mr. Joseph fully discusses this point in reference to another very suitable example: 'If Hannibal had marched on Rome after Cannae, he would have taken it.' "This judgment," says he, "makes an assertion; in doing so it declares something to hold good of the real, for it declares its own content to be true." But neither event actually happened. This judgment therefore states

* Bradley, *Principles of Logic*, p. 87.

an unfulfilled contingency, and how can that be real?"* Badrī BĀDRI SENĀMI

The problem is only an aspect of the fundamental problem of metaphysics, *viz.*, the relation of Thought and Reality. The only answer Logic can give is that the supposition expressed by the antecedent is itself based upon Reality, and the proposition really means: "Reality has a character, such that, the case of one will be followed by so and so." If the assertion implied here is true, the hypothetical judgment is also true, in spite of the fact that its antecedent and consequence may sometimes be impossible.† This type of judgment is mainly concerned with abstract truth, which no doubt implies reality or fact *indirectly*, and cannot express fact directly. The Hypothetical proposition has, therefore, a reference to reality but only *indirectly* (through its corresponding categorical assertion).

* "Every hypothetical judgment," continues Mr. Joseph, "presents this problem; for it asserts that under certain conditions something would exist or have existed, but not that the conditions are realized, nor therefore that it does or will exist or has existed. Nor does its truth require this; in order that an hypothetical judgment should be true, neither condition nor consequent need be realized; and yet if an hypothetical judgment is true it is true of reality, and reality, we may urge, is actual; what then does the hypothetical judgment affirm to be actual in the real. We speak freely of unrealized possibilities, as if they existed as well as realized actualities, how are we to think of what we so freely speak of? When we reflect, in Logic, upon the hypothetical form of judgment, we become conscious of the problem." (Joseph, *op. cit.* p. 166.)

† Read Bosanquet, *op. cit.*, p. 123.

This, however, implies that the Hypothetical form of judgment can always be translated into the Categorical. It is doubtless true that the former always rests on a categorical basis, i.e., relativity rests on fact, an absolute datum of reality. The hypothetical form asserts a condition as a *fact* and thereby is 'categorical' to some extent. This leads us to discuss *the relation of the Hypothetical to the Categorical proposition*. We know that the former is more abstract and that it has an indirect reference to reality. Sometimes it can easily be converted into the categorical form, while at other times the meaning of the proposition, as intended by the reasoner, is affected. The substitution of 'the case of' or 'reality is such that' for 'if' may really be more of a logical dodge, intended to give the Hypothetical form the outward appearance of the Categorical. The real nature of hypothetical reasoning remains unaltered, since the difference between the two forms is, as Dr. Schiller points out,* psychical, and it is such psychical difference which is likely to be blurred in reducing hypotheticals to categorical form. The hypothetical form is itself ambiguous inasmuch as it has a plurality of senses. It might express mere supposition or it might indicate doubt. It depends on the context to determine the actual sense in which it makes an assertion. So much on the reduction of hypotheticals to categorical form. Now let us take up the other side, *viz.*, the statement that Categoricals are on analysis reduced to hypothetical form.

* Schiller, *Formal Logic*, p. 229.

This statement is made in view of the categorical proposition appearing as a puzzle, as it is difficult to see how the form "All A is B" can assert the existence of A when it would remain true though A did not exist. For example, "All trespassers will be prosecuted" is held to remain true although 'trespassers' may not exist. One would here naturally ask, does it not mean "If there are any trespassers, they will be prosecuted"? This consideration led Mr. Bradley * to turn the table completely on the vulgar view by maintaining that all categorical judgments are secretly hypothetical. The following are the three arguments on which Mr. Bradley bases his view:—

(i) *Because categorical judgments are ambiguous.*

"It rained last Tuesday," may mean *any* Tuesday, not necessarily *this* last Tuesday. If we keep to ideas we do not utter our meaning. Thus categorical judgments do not categorically affirm.

(ii) *Because they express only an arbitrarily selected part of the content of Reality.* If we say "This tree is green," we are asserting a mere fragment of reality. The tree is much besides being "green." But this is not stated and therefore falsifies the judgment.

(iii) *Because, e.g., "tree" in "The tree is green" predicates nothing but universals of reality.*

* Read Bradley, *op. cit.*, Bk. I, ch. II, esp. pp. 62-63, and 83 ff.

“Tree” and “green” may be predicated in any number of other situations and the whole assertion is anything but the categorical statement of the particular fact it professes to be.

Besides, the mere analysis of a universal categorical judgment reveals its true hypothetical character. For example in “Animals are mortals” do we speak only of animals existing now or of those as well that will be born hereafter? What we mean is “Whatever is an animal will die,” which is no other than “*If anything is an animal then it is mortal.*” Thus even a Categorical judgment asserts a mere *hypothesis* and not a *fact*: thus it is always hypothetical. It says “*Given one thing, you will then have another.*” Mr. Bradley concludes that if judgment is the union of ideas, there can be no Categorical judgment.

Just the opposite is the standpoint of Pragmatism. Mr. Bradley holds that judgment refers to reality hypothetically: the Pragmatist maintains that in every judgment the reference to reality is direct, since there can be no chasm between thought and reality in the process which “constructs” both truth and reality. Judgment only affirms a reality which it has itself distinguished from unreality. “Every judgment,” observes Dr. Schiller, “is experimental and takes a risk in claiming to be true and to be applicable to reality, and this is precisely the reason why it is made; but to call it ‘hypothetical’ on this account is to use the word in a different sense from that

originally professed." (p. 142). Moreover, the *intention* in each case is different. In the Hypothetical it is to state the connexion of two *possibilities*, while in the Categorical it is not to *express* the possibilities of failure.

The following is the **Pragmatist's** reply* to Mr. Bradley's three arguments stated above:—

(i) We admit the indeterminateness of the Abstract judgment, but we add that it is quite irrelevant. Our logical examples may be ambiguous in the abstract and yet convey a precise meaning in actual use. For, as logical examples, our judgments are not yet particularised as they must be when used, whether or not the hypothetical form is retained. Mr. Bradley ought to have shown, not that they may be hypothetical but they never can convey a meaning categorically, and this all our forms can do, though their mere form does not decide what is strictly a question of fact.

(ii) This objection rests on the notion that a judgment to be true should copy reality. Mr. Bradley is quite aware of the defects and difficulties of the copy-theory of truth: yet he constantly denounces cognitive processes because they do not copy. From the pragmatic standpoint judgment

* We acknowledge our indebtedness to Dr. Schiller, on whose lecture-notes this reply is based.

always selects and never copies. All judgments and all truths rest on selection throughout. In a judgment we only assert a part of the whole content of reality and that is all we need. A judgment is true if it satisfies our immediate purpose in making it. Its defects for different purposes do not falsify it. It is an *ignoratio elenchi* to suggest that. If I am only interested to judge the tree "green," what does it matter that it is so many feet high, growing in such and such locality, with leaves of such and such shape and so on?

(iii) Though all words are universal and can often be used indefinitely, yet they are fully particularised by their use. Neither can they be used in the same sense in another situation. Hence the judgment as it was meant was fully categorical because it was dated. Mr. Bradley's puzzles spring (according to Dr. Schiller) from his misconceiving the nature of Truth and taking the judgment out of its context in actual knowing and declining to consider the logical character of *human* thought. It is nothing but the particularity of its application and use which renders a judgment of whatever broad hypothetical is categorical. In

use all forms of judgment are categorical ; in *abstraction* all are equally hypothetical —i.e., their meaning has become conjectural.

(3) **The Disjunctive Proposition.**—In place of the “if” of hypotheticals we have in this type the “either—or,” which implies more categorical certainty than the former. The Disjunctive form enumerates *alternatives*, and in order that it may have any logical value, these alternatives must be *exhaustive*. Its relation to the categorical is thus analogous to that in which Division stands to Definition. As the disjunctive “either—or” expresses less of supposition and more of categorical certainty, it is held by several logicians that the Disjunctive is logically prior to the Hypothetical.*

The following are the main types in which the Disjunctive may be expressed :—

- (i) **A** is either **B** or **C**.
- (ii) Either **A** is **B**, or **C** is **D**.
- (iii) Either **A** or **B** is **C**.

On analysing the Disjunctive form we find that its categorical basis is more explicit and direct than that of the Hypothetical. When we say “This wall is to be painted either green or yellow” we at once imply

* The view that the Disjunctive is logically prior to the hypothetical is well brought out and maintained by Boyce Gibson, *op. cit.*, p. 112.

the categorical basis that "this wall is to be painted in *some colour*." This categorical element is present in every Disjunctive judgment. Besides, there are present in it two Hypothetical judgments,—(1) 'If it is painted green, it is not painted yellow' (which also implies its equivalent 'if it is painted yellow, it is not painted green') and (2) 'If it is not painted green, it is painted yellow' (which also implies its equivalent, 'If it is not painted yellow, it is painted green'). The first of these shows that the alternatives enumerated are *exclusive*, * while the latter shows that they are also *exhaustive*.

The Disjunctive is not a mere combination of Hypotheticals, since the latter are in no sense independent elements but only the result of *our* analysis; the combination is our own mental act and does not lie in the hypotheticals themselves. The ground of all hypotheticals is categorical. As the Hypothetical has its basis in the Categorical inasmuch as it makes an assertion, but at the same time goes beyond the latter by asserting the relation of antecedence (condition) and consequence; so too the Disjunctive involves Hypotheticals but only as alternatives, and therefore it asserts the truth of one or the other of these alternatives.

Does the Disjunctive state a fact?—Surely "either—or" cannot express any real fact, because it could be one of the two or both and nothing between them. If

* For a discussion of the question whether the alternatives should be treated as mutually exclusive read B. Gibson, p. 132.

A represents a real fact, it cannot be "either-B-or-C." But at the same time the Disjunctive does not imply mere ignorance, but makes an assertion, since if the real fact A in the proposition "A is either B or C" is proved not to have any existence, then the statement embodied in the proposition is false. Besides, we know that the Disjunctive implies the truth of one of its alternatives and there is no sufficient reason to deny that an alternative can be called a fact.

5. Forms of Modality.—On the basis of *modality* propositions are divided into assertoric e.g., "S is P," "S is not P," problematic e.g., "S may be P," "S may not be P," and apodictic e.g. "S must be P," "S cannot be P." The first expresses *actuality*, the second *possibility* and the third *necessity*. These distinctions do not affect or qualify the predicate of the modal proposition but the judgment itself. It is the copula that undergoes modification in order to express the manner in which we think a judgment with regard to its truth, i.e., the manner in which the predicate belongs to the subject. In Kant's words, the assertoric judgment "implies logical reality or truth," the problematic expresses "a free choice of admitting such a proposition, and a purely optional admission of it into the understanding,"* and the apodictic is really the same as the assertoric, except that it makes some *a priori* law of thinking the matter of the judgment. But as Formal Logic is not concerned with

* i.e., it implies that a certain judgment is not necessarily false, but bears no positive testimony to truth.

the 'matter' of judgments it does not admit the distinction between assertoric and apodictic propositions. It regards all propositions as assertoric.

Dr. Schiller regards these forms of modality as full of ambiguities and confusions.* For instance, an assertoric judgment cannot be distinguished from a categorical in accordance with the principles of Formal Logic, as both are in the same form and their difference is due to their meaning only. Again, there is confusion in the problematic and apodictic as well: the different degrees of possibility and necessity are not discriminated and it is not determined whether the possibility and necessity is subjective or objective. Possibility and necessity depend on human attitudes towards reality.

After this brief discussion of the main types of propositions decided according to Quantity, Quality, Relation and Modality, we now proceed to consider other supplementary divisions.

6. Other Divisions.—As to their *matter* propositions may be distinguished as analytic and synthetic, and great importance was attached to this distinction by Kant. The former are so called because the predicate simply analyses or explicates the meaning of the subject, and in fact is itself contained (though covertly) in the subject, *e.g.*, "All bodies are extended," "A square has all its sides equal," etc. In these propositions the predicate adds nothing new to the subject but itself belongs to it. The meaning of "body"

* Read Schiller, *op. cit.* p. 144 ff.

is "extended substance," "the equality of four sides" is a part of the definition of a "square." The latter, *viz.* Synthetic, are so called because in them the predicate adds something new to the meaning of the subject, *i.e.*, the predicate lies outside the subject although it is connected with it. For instance "Bodies are heavy," "Water boils at 100°," etc. The definition of 'body' does not include the 'heaviness,' and the definition of 'water' does not necessarily imply its 'boiling at a certain temperature.' Thus we may define an **Analytic Proposition** as one in which the predicate is contained in the definition of the subject, and the **Synthetic Proposition** as that in which the predicate is not contained in the notion of the subject but falls outside it. The former may thus be called **explicative** and the latter **augmentative**.

This distinction, emphasised by Kant, is not free from confusion. It is at best a psychological distinction, useless for logical purposes. We have already observed that every judgment involves both analysis and synthesis, and no judgment exists in which there is pure analysis or pure synthesis. Further, the same proposition may express an analytic judgment to one and synthetic to another according to the state of their knowledge. For instance the proposition "All members of the Syndicate are members of the Senate" is an analytic judgment to those acquainted with the constitution of universities, while it is a synthetic judgment to other people. Thus an analytic judgment may also be looked upon as a superior kind of

knowledge. Moreover, what is analysis subjectively is usually synthesis objectively, and *vice versa*. Kant's distinction is not very clear, since all his 'synthetic' judgments are not necessarily **augmentative**. This distinction is set aside by Dr. Schiller* as quite worthless for the analysis of actual thinking. It reduces 'analytical' judgments to tautologies, renders it arbitrary what judgments are analytic, makes 'analytic' or 'synthetic' relative to the state of one's knowledge, and leaves the existence of analytic judgments quite unintelligible.

The terms 'analytic' and 'synthetic' are, as used by Kant, misleading ; but in their place we might now substitute **essential** and **accidental**. The former indicates those in which the predicate is contained in and is part of the subject, while the latter, those in which it is not so.

Analytic propositions may as well be called **Verbal** since their truth rests on the conventional meaning of words ; while synthetic propositions may be called **Real**, inasmuch as their truth does not rest merely on the meaning of words but on matters-of-fact, the nature of things.

Analytic propositions are also called *a priori* since they express judgments whose truth is independent of (or 'prior to') experience ; while those of the other kind are known as *a posteriori* since they express judgments which are derived from (or 'posterior to') experience.

* *Op. cit.* p. 149.

The *fundamentum divisionis* in all the above cases should not be taken to be the same. Hence it is not true that all analytical propositions are necessarily essential, verbal and *a priori* at the same time.

There is, also a rather unimportant distinction between **exclusive** and **exceptive** propositions. The former contain some word which confines the application of the predicate to the subject, e.g., "I, even I only am left," 'Elements alone are metals' 'Only graduates are eligible.' The latter except from its application a certain part of the extension of the subject, e.g. 'None may be admitted, except on business.' 'All are welcome except smokers.' These are the two most important classes of what is known as the **Exponible Proposition** and which may be defined as a compound proposition whose composition is not obvious ; or, as "a categorical proposition which, though apparently simple, is really capable of being resolved into two or more simple propositions." There is also another form of the Exponible proposition, viz., the **Inceptive** or the **Desitive** proposition—which asserts something as *beginning* or *ending* ; e.g., "Logic has, for many years, ceased to be a compulsory subject for the Calcutta M. A. Examination."

SUMMARY.

Propositions may be classified on various principles. On the basis of the mere external form they may be divided into **Simple**, **Compound** and **Complex**.

The following is, however, a more logical and better classification :—

(1) <i>Quantity</i>	...	Universal	:	"All S is P."
		Particular	:	"Some S is P."
(2) <i>Quality</i>	...	Affirmative	:	"S is P."
		Negative	:	"S is not P."
(3) <i>Relation</i>	...	Categorical	:	"S is P."
		Hypothetical	:	"If A is B, it is C."
		Disjunctive	:	"A is either B or C."
(4) <i>Modality</i>	...	Assertoric	:	"A is B."
		Problematic	:	"A may be B."
		Apodictic	:	"A must be B."

Quantity.—Singular propositions are treated like Universal propositions, and Indefinite as Particular (except when they are Generic). Enumerative propositions are usually ranked with the Singular.

Quality.—Infinite propositions such as 'S is not-P' are classed under affirmative, and are not recognised in Formal Logic as a separate class. Negative propositions, being ultimately grounded in some *positive* fact, have a claim to truth. If reality is a *system*, negation is as necessary as affirmation. Negation is, however, more subjective than affirmation.

Relation.—Categorical propositions contain a direct reference to reality: their assertion is absolute and unconditional. Hypotheticals are more abstract and the relation they assert need not be realised in

experience. **Disjunctives** make an assertion with an alternative. The elements of the former type are *terms*, and of the latter two types *propositions* or *clauses*. In Hypotheticals the clauses are related to each other as 'antecedent' and 'consequent' while in Disjunctives they are only 'alternatives.' Hypothetical propositions may be true even though their realisation were impossible. Their legitimate function is to assert that if certain conditions were fulfilled something would exist. Their truth-claim rests on the fact that the *supposition expressed by the 'antecedent' is itself based upon Reality*.

Hypotheticals may be given an outward appearance of Categoricals, but even then the nature of hypothetical reasoning remains unaltered.

All Categoricals are secretly hypothetical, inasmuch as they are ambiguous and express only an arbitrarily selected part of the content of Reality. Their mere analysis reveals their hypothetical character. (Bradley).

The opposite view is that in every judgment there is *direct reference to reality* (Pragmatism).

Disjunctive propositions enumerate alternatives, and it is necessary that these alternatives must exhaust the possibilities. In order to keep up scientific precision they must be reciprocally *exclusive* besides being *exhaustive*.

The categorical basis of Disjunctives is more explicit than that of Hypotheticals. Disjunctives are not mere combinations of Hypotheticals but are necessarily grounded in categoricals. Disjunctives have a

truth-claim in so far as their alternatives are treated as facts. They also "make negation positively significant." (Bosanquet).

Modality.—The distinction between **assertive** and **apodictic** propositions is useless for Formal Logic, as it is based not on the 'form' but the 'matter' of judgments. There is good deal of confusion and ambiguity in the forms of modality.

As to their *matter* propositions may be distinguished as **analytic** and **synthetic**. The former are those in which the predicate is contained in the definition of the subject, while in the latter the predicate adds something new to the meaning of the subject. This distinction is not altogether free from ambiguity and confusion, and the better terms to use are **explicative** and **augmentative**. The former are also known as **Verbal** and the latter **Real**. Analytic judgments are *a priori*, since they exist prior to experience or are independent of it, while synthetic judgments are *a posteriori*, being derived from experience.

Exclusive propositions deny the predicate of all but the subject, while **Exceptive** propositions affirm the predicate of the whole subject except a certain part.

CHAPTER IV.

FOURFOLD SCHEME OF PROPOSITIONS AND DISTRIBUTION OF TERMS.

1. **Fourfold Scheme of Propositions.**—The divisions of propositions according to *Quantity* and *Quality* are independent of each other ; hence by combining them we get the following four logical forms of Propositions ;* which are for convenience of reference indicated by the letters A, E, I, O respectively :—

- A—Universal Affirmative : 'All S is P' : SaP.
- E—Universal Negative : 'No S is P' : SeP.
- I—Particular Affirmative : 'Some S is P' : SiP.
- O—Particular Negative : 'Some S is not P' : SoP.

The student should make himself quite familiar with these four symbols and note that A and I are the first two vowels in the word 'affirmo,' while E and O are the two vowels in 'nego.'

Illustrations :—

- A : All dogs are animals.
- E : No planets are self-luminous.
- I : Some women are graduates.
- O : Some men are not happy.

The following observations will help in determining the logical form of a categorical proposition :—

- (i) The word 'Some' should be interpreted as '*some at least*' and not as '*some, not all*.' In other words, it does not necessarily exclude '*all*.' Whenever we are in doubt

* This classification assumes that all propositions may be given a meaning in extension.

as to the quantity of a proposition it is always less risky to regard it as particular.

(ii) 'Singular' propositions are, for logical purposes, treated as 'universal.' Thus "India is a vast country," "William is intelligent," "This room is warm," etc. would be treated as propositions in A form, while "This table is not large" as E form.

(iii) Propositions introduced by 'Every' or 'Any' (logically equivalent to 'All'), are considered as 'universal' if in the affirmative, and 'particular' if in the negative form. Propositions introduced by 'each' are treated as 'universal.'

(iv) 'Most,' 'Many' and 'Few' are generally taken to mean 'some.' 'Most' means 'at least more than half,' and 'Few' has a negative force, as 'Few S is P' = 'Most S is not P.' But 'A few' must be distinguished from 'few.' It is regarded as affirmative and is usually an equivalent of 'some'; thus 'A few S is P' = 'Some S is P.'

(v) Exclusive propositions, i.e., such as contain 'only,' 'alone,' 'none but,' are treated as 'universal.'

(vi) In all cases the logical form of a proposition should be determined by its *meaning*.

2. Reduction of Propositions to Strict Logical Form: TYPICAL EXAMPLES.—We now give below a few typical examples illustrating the mode of reducing given sentences or propositions to their strict logical form:

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- (1) He has no home but Calcutta.
=All places outside Calcutta are not homes for him E.
- (2) Not all who are called are chosen.
=Some persons called are not persons chosen O.
- (3) None but Indians are Philosophers.
=No not-Indians are philosophers . E.
or =All philosophers are Indians . A.
- (4) Only short wars are popular.
=No not-short wars are popular wars. E.
or =All popular wars are short wars . A.
- (5) All my efforts could not save you.
=No efforts of mine are efforts that could save you. E.
- (6) All my pupils play cricket.
=All my pupils are cricketers . . A.
- (7) Every miser envies other's wealth.
=All misers are persons envious of other's wealth A.
- (8) All princes are not generous.
=Some princes are not generous persons. O.

(9) Five and seven are twelve.

=The sum of the numbers five and seven is the number twelve. . . A.

10. A few tickets are still available.

=Some tickets are tickets still available. I.

(11) Scarcely any one succeeded.

=The number of persons who succeeded is a very small number . A.

(12) Afflictions are often salutary.

=Some visitations of afflictions are salutary experiences. . . . I.

(13) When the cat's away mice play.

=All cases of the cat's absence are cases of the mice playing . . . A.

(14) Women are hysterical.

=Some women are hysterical . . . I.

(15) A little knowledge is dangerous.

=A smattering of knowledge is a dangerous thing A.

(16) Only the ignorant hold such opinions.

=All persons holding such opinions are ignorant persons. . . . A.

or =All non-ignorant persons are-not persons holding such opinions . E.

3. Diagrammatic Representation of A, E, I, O.—

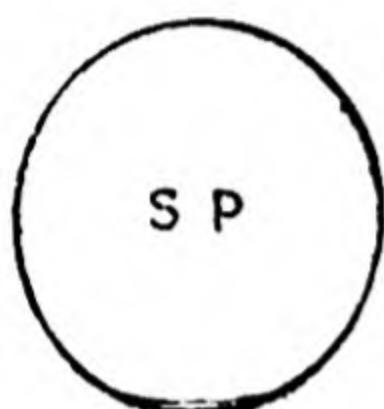
Diagrammatic representation of propositions is possible only when both the subject and the predicate are considered in *extension*. Its function consists in furnishing a concrete representation of the relations

between the terms of a proposition in a way easily understood by mere sight. In order to be satisfactory the diagrams must fulfil the following conditions :—

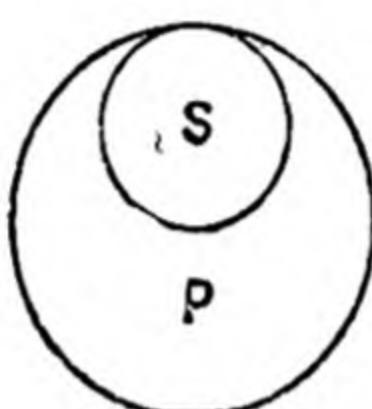
- (i) As soon as the principle of their construction is understood, the relation expressed by them should be self-evident.
- (ii) Each diagram should represent only one relation, and should, therefore, be capable of only one interpretation.
- (iii) Each proposition should be represented by only one diagram.

Various methods of diagrammatic representation have been suggested by logicians, the more outstanding being (1) the method adopted by the Swiss logician Euler (1707—1803), by which S and P are represented each by a circle, (2) the system of the German logician Lambert (1728—1777), by which two horizontal straight lines, drawn one above the other, represent S and P, the lower standing for the subject and the higher for the predicate, and a dotted line indicating an *undistributed* term, (3) the method adopted by Venn in his *Symbolic Logic*, in which although circles are employed yet a different use is made of them ; this method is based on the view that all universal propositions could be adequately represented by denying the existence of certain classes—such being represented by shading out the compartment. Of these systems the one devised by Euler is the best known and the most popular.

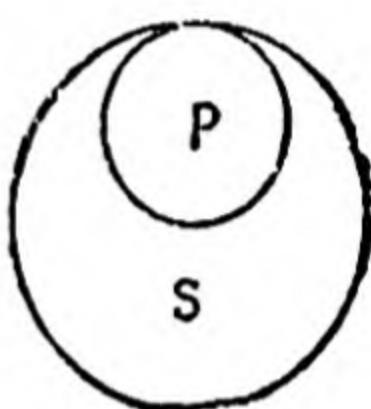
4. Euler's Circles.—In Euler's system a circle represents the individuals or things included in any class, or denoted by any term. All possible relations between two classes are represented by the following five diagrams :—



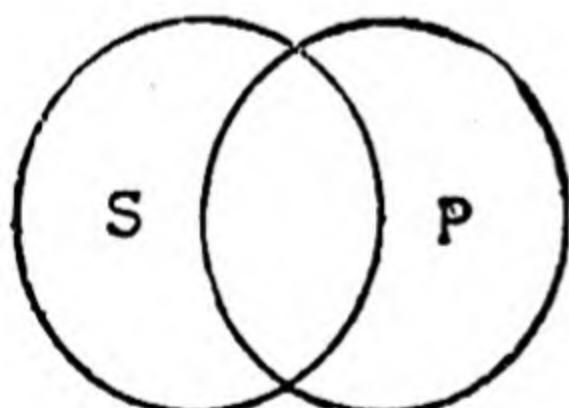
I.



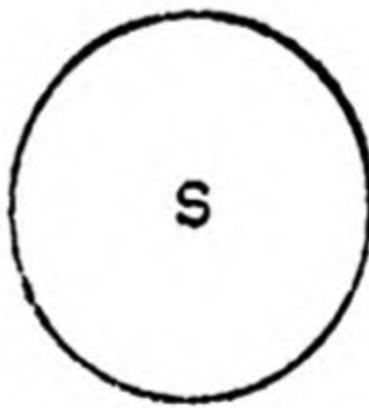
II.



III.



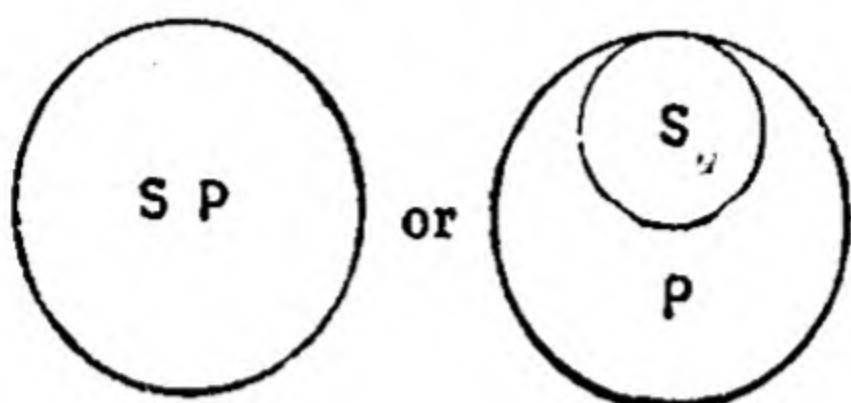
IV.



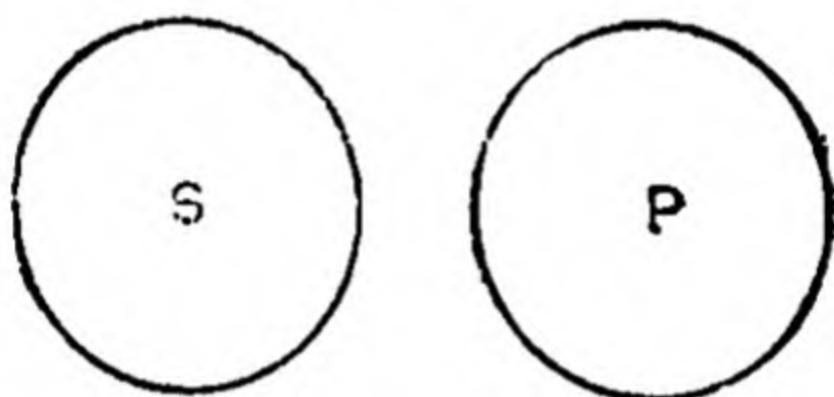
V.

In Diagram (i) S coincides with P; in (ii) S is wholly included in P; in (iii) S wholly includes P; in (iv) S partially includes and partially excludes P; and in (v) S entirely excludes P.

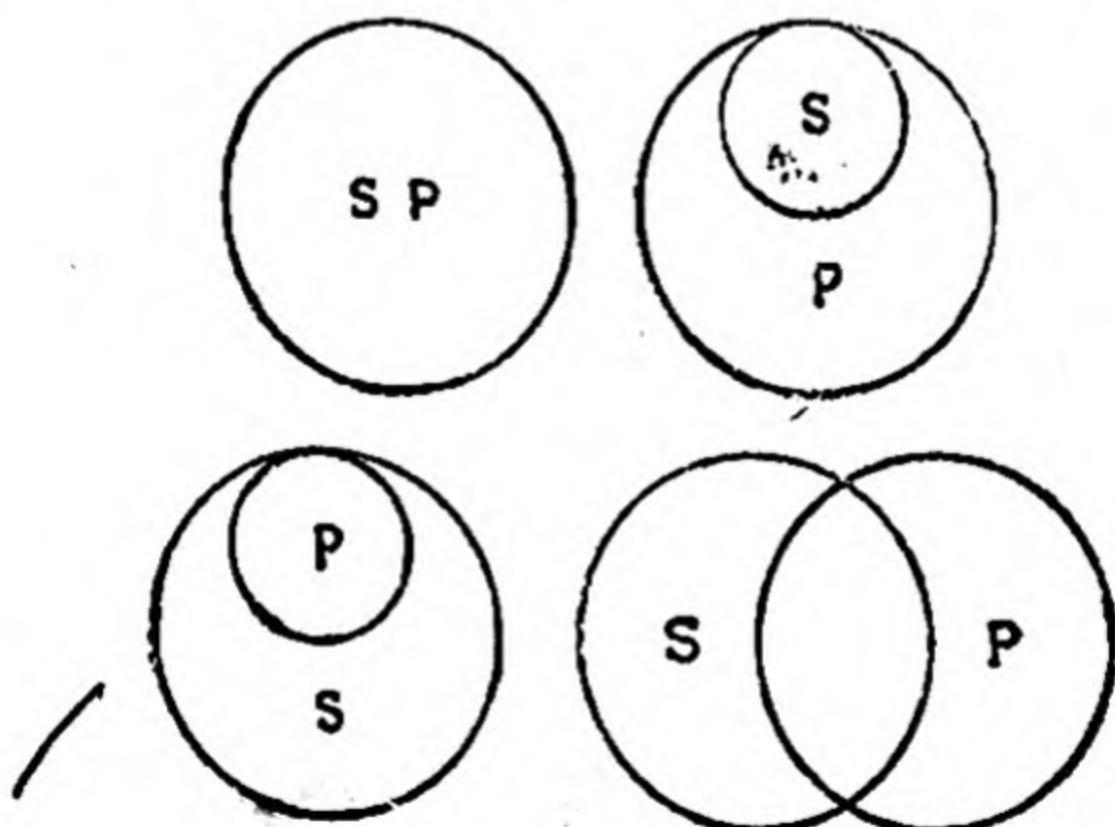
A propositions, such as 'All S is P,' will be represented by Diagram No. (i) or (ii), thus :—



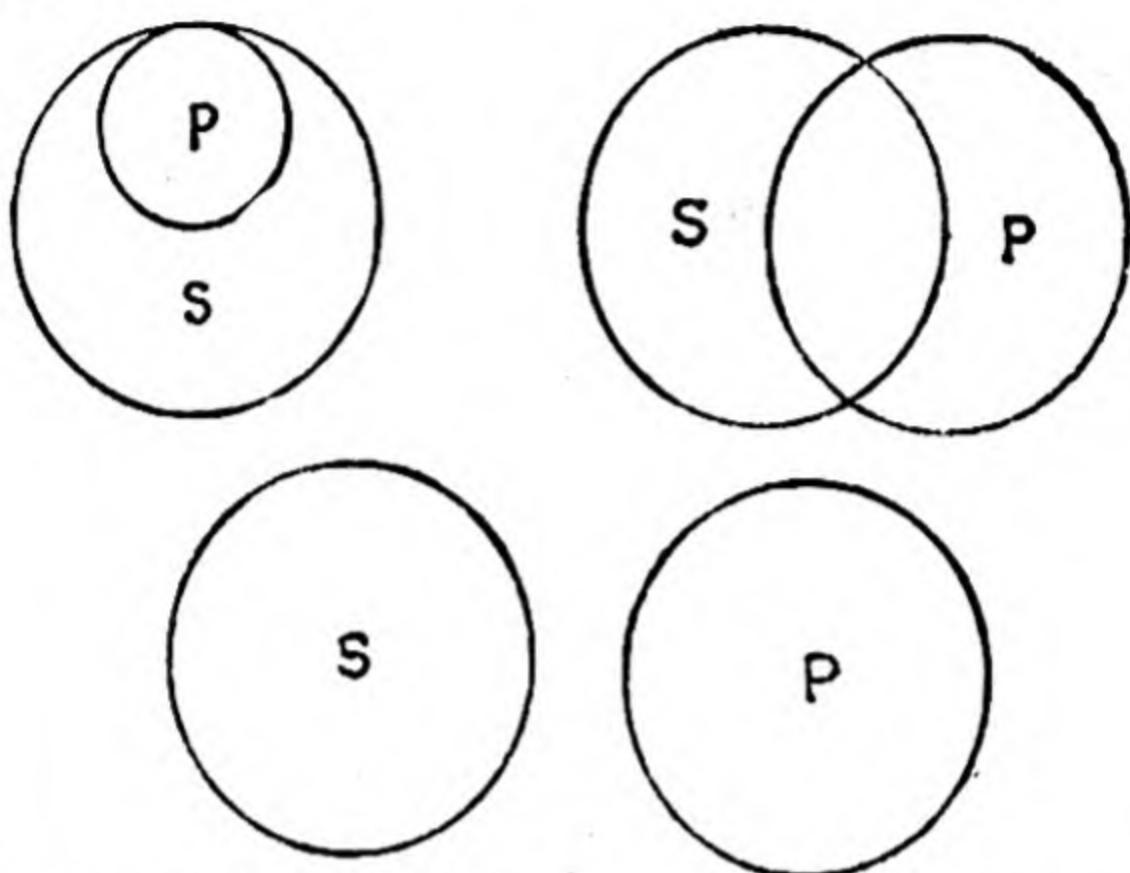
E propositions, such as 'No S is P,' will be represented by Diagram No. (v) only; thus :—



I propositions, such as 'Some S is P,' will be represented by any of the first four diagrams, thus :—



O propositions, such as 'Some S is not P,' will be represented by any of the three diagrams (iii), (iv) and (v), thus :—



This fivefold scheme is not based on the predicative view but on an analysis of the possible relations between classes, and therefore cannot be made to fit in with the fourfold scheme of A, E, I, O. Although these diagrams are easily understood and self-evident, yet, as we have seen, each diagram is capable of more than one interpretation and each of the four logical forms of propositions except E can be represented by more than one diagram. Venn warns us against an injudicious use of these diagrams—e.g., by Hamilton and Jevons—by the remark that “the common practice, adopted in so many manuals, of appealing to these diagrams—Eulerian diagrams as they are often called—seems to me very questionable. The four propositions A, E, I, O, do not exactly correspond to the five diagrams, and consequently none of the moods in the syllogism can, in strict propriety, be represented by

these diagrams.* So far no perfect system has been devised simply because such a one is impossible.

5. **Distribution of Terms.**—A term is said to be **distributed**—and this is possible only within a proposition—when it is used in its whole extent, i.e., when it refers to all that it can denote. A term is said to be **undistributed**, when it is not used in its whole extension but only in part.

In considering the propositions A, E, I, O, from this point of view, we have to consider the distribution of the Subject and then of the Predicate, in each of these forms.

(a) **Distribution of Subject.**—From the very definition of distribution it follows that the Subject is **distributed** in universal propositions and **undistributed** in particular propositions.

(b) **Distribution of Predicate.**—The Predicate is **distributed** in negative propositions and **undistributed** in affirmative propositions. In the proposition 'No S is P' the whole of S is excluded from P, and therefore the whole of P is also excluded from S: hence both S and P are **distributed**.

Thus, in A the subject is distributed but the predicate is undistributed; in E both the Subject and the

* *cf. Symbolic Logic*, p. 15. The diagrams have been correctly used by Ueberweg, and Dr. Keynes mentions the following occasions when they could be employed with advantage:—
 (i) To illustrate the distribution of the predicate in a proposition; (ii) To illustrate the Opposition of Propositions; (iii) To illustrate the Conversion of Propositions. (*cf. Formal Logic*, pp. 98—100.)

Predicate are distributed ; in I both the Subject and the Predicate are undistributed ; and in O the Subject is undistributed while the Predicate is distributed. This may be briefly summed up as follows :—

A distributes S only.

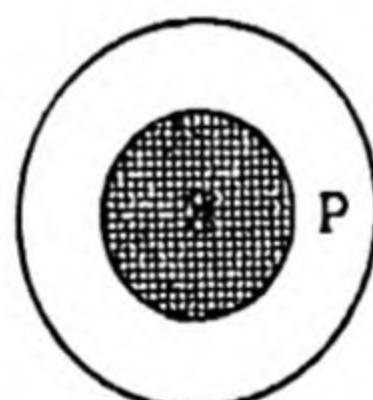
E distributes both S and P.

I distributes neither S nor P.

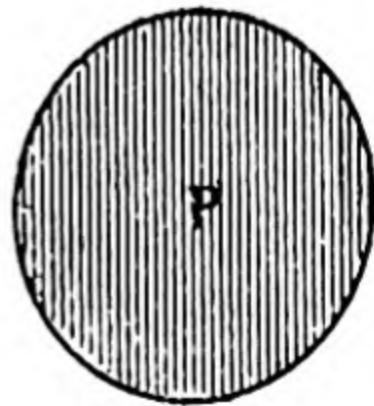
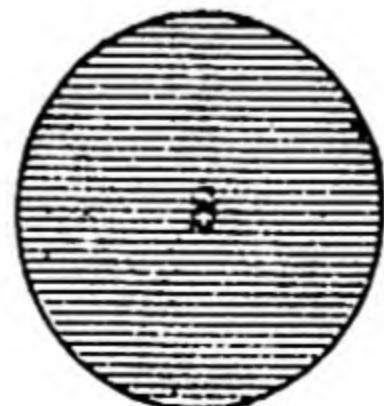
O distributes P only.

6. **Its Diagrammatic Representation.**—The results arrived at about the distribution of the Subject and the Predicate in the four logical propositions may be represented by the following diagrams in which 'distributed' terms are indicated by completely shaded circles and 'undistributed' by partially shaded circles :—

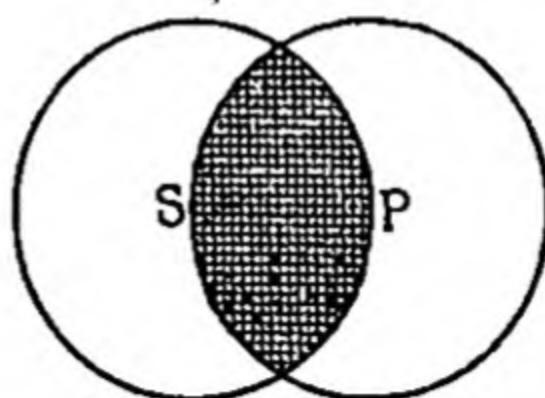
A proposition :



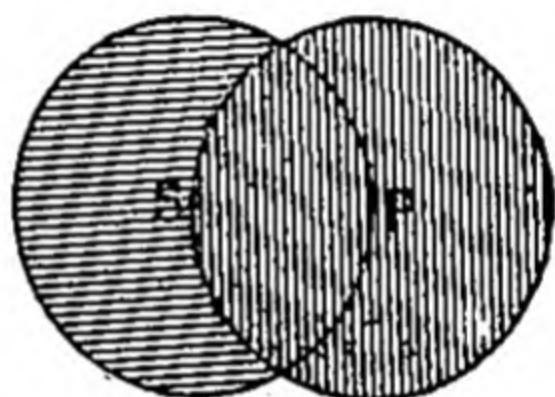
E proposition :



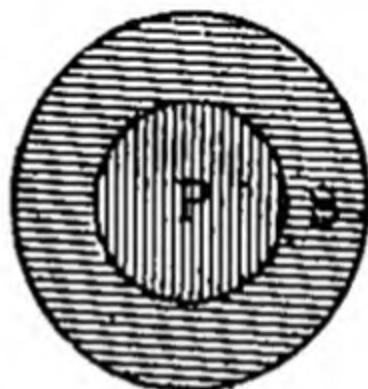
I proposition :



O proposition :



or



7. **Quantification of the Predicate**—In order to get rid of the ambiguity in the four forms of propositions and to develop that scheme further, Sir William Hamilton proposed to affix a mark of Quantity to both the Subject and the Predicate: this theory is known as the *Quantification of the Predicate*. He held the maxim that we must always state explicitly what is thought implicitly, and as we quantify the Predicate implicitly (in our thought), the quantity should, on demand, be expressed in language. Thus, *Predicates may be of any 'quantity' in propositions of any quality.*

Taking the four forms A, E, I, O and making the Predicate of each (i) Universal and (ii) Particular. Hamilton obtained the following eightfold scheme.*

Form A	... { All S is all P ...	... U
	... { All S is some P	... A
Form E	... { No S is any P	... E
	... { No S is some P	... y
Form I	... { Some S is all P	... Y
	... { Some S is some P	... I
Form O	... { Some S is not any P	... O
	... { Some S is not some P	... w

Thus, in addition to A, E, I, O, we have according to this scheme, a set of another four, viz. U, y, Y, w. The eight symbols commonly employed in the scheme of 'Qualification' are said to have been introduced by Archbishop Thomson. Using these as formulas we get SuP, SaP, SeP, SyP, SyP, SiP, SoP, and SwP. Corresponding to these we give below the symbols adopted by Hamilton: here *f* stands for the affirmative copula, *n* for the negative copula, *a* for a distributed term and *i* for an undistributed term:—

A { <i>afa</i>	...	... U	...	... SuP
<i>afi</i>	...	... A	...	... SaP
E { <i>ana</i>	...	... E	...	... SeP
<i>ani</i>	...	... y	...	... SyP
I { <i>ifa</i>	...	... Y	...	... SyP
<i>ifi</i>	...	... I	...	... SiP
O { <i>ina</i>	...	... O	...	... SoP
<i>ini</i>	...	... w	...	... SwP

* For the important results that were claimed to follow from this scheme, read Welton, *Manual of Logic*, vol. I, p. 201.

Hamilton's eight forms may easily be reduced to the following six. In this scheme v stands for 'a part of' (undistributed term) and $x\text{-}p$ represents not- P . Thus :—

- A : — (i) $S = P$
- or (ii) $S = vP$
- E : (iii) $S = v(x = P)$
- I : (iv) $vS = vP$
- or (v) $vS = P$
- O : (vi) $vS = v(x = P)$

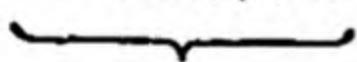
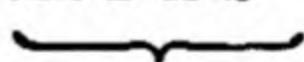
Archbishop Thomson too rejected the forms y and w on the ground that although they were conceivable yet they were not actual cases of negative Predication.

8. **Criticism of the Doctrine.**—The doctrine of the Quantification of the Predicate is now generally discredited and discarded by logicians. Its very fundamental principle that the predicate of a proposition is thought in extension is not true,* and if that is so, the whole scheme of Hamilton loses its significance. Take the proposition 'All men are mortal.' According to this theory, this will have to be stated as "All men are some mortals." But this is not the way in which we actually think. We regard the predicate only as an attribute and do not take it in extension.

The four additional propositions U , y , Y , w proposed by Hamilton are on analysis found to be superfluous.

U proposition : 'All S is all P '

= 'All S is P and All P is S '

A

A

* For a detailed criticism of this point read Joseph, p. 198 ff., Welton I p. 201 ff.

y proposition: 'No S is some P'

= 'Some S is no P'

O

Y proposition: Some S is all P'

= 'All P is S'

A

w proposition: 'Some S is not some P.'

(This proposition cannot be denied, whatever we intend to state: being a truism it is useless).

Thus U is reduced to two A propositions, *y* to O, *Y* to A, and *w* is found useless as it conveys no information. Hence we fall back upon the fourfold scheme.

Mill also rejects Hamilton's theory on the ground (i) that we do not actually quantify the predicate in our thought, and (ii) that all reasoning is carried on in the ordinary forms of expression. It has further been pointed out by some logicians that the strict logical "some" makes no difference in the propositions quantified, except to introduce a useless awkwardness of expression.

The doctrine has hardly anything to recommend itself. It has misled people to suppose that in a proposition two terms are taken in extension, that in it a subject is either included in a class or excluded from a class, and that a class is simply a number of things. It has also to account for the prevalent custom of representing the relation of terms in a proposition by

the relative position of two circles, one included in the other, excluded from the other or intersecting the other. We must therefore reject this doctrine in favour of the ordinary fourfold scheme.

SUMMARY.

If we combine the two principles of division, *viz.*, Quantity and Quality, we get the following four fundamental forms of Propositions :—

(1) Universal Affirmative : SaP	denoted by the symbol	A
(2) Universal Negative : SeP	„ „ „	E
(3) Particular Affirmative : SiP	„ „ „	I
(4) Particular Negative : SoP	„ „ „	O

The logical form of propositions should be determined by their *meaning*.

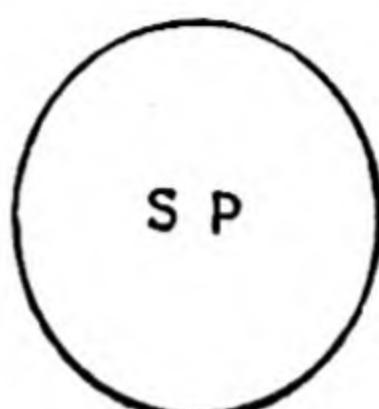
Diagrammatic representation of Propositions is only possible in regard to the extension of their terms. In order to be adequate it should satisfy the following conditions :—

- (1) The relation expressed by the diagrams should be self-evident.
- (2) Each diagram should represent only one relation, and
- (3) Each relation should be represented by only one diagram.

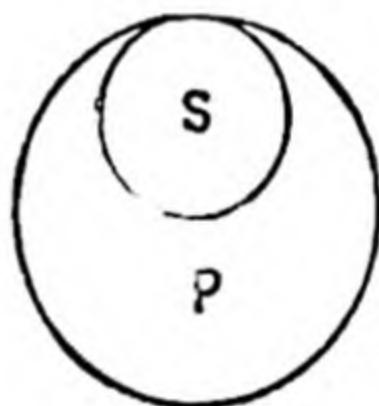
There are several methods of diagrammatic representation, but Euler's is the best known. But although fulfilling the first condition, Euler's method fails in regard to the remaining two. Euler was a

Swiss logician of the 18th century. His fivefold scheme is represented by the five diagrams, which express—

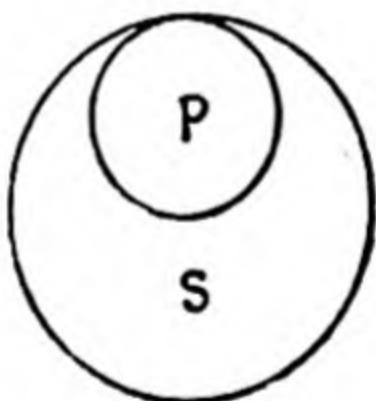
(i) All S is all P



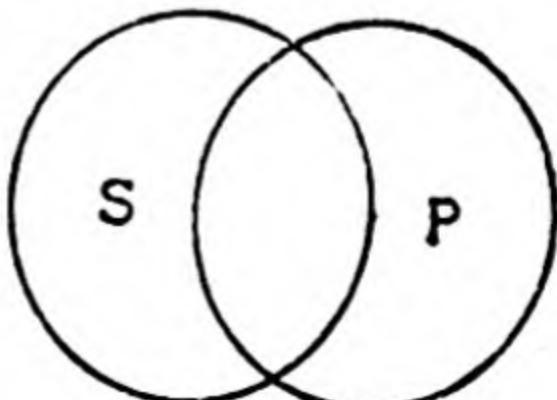
(ii) All S is some P



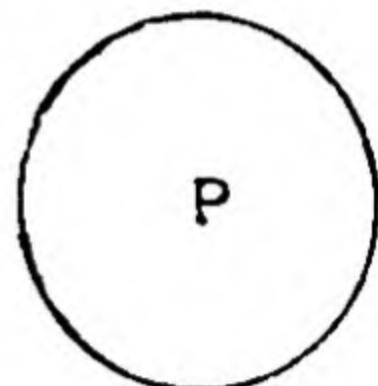
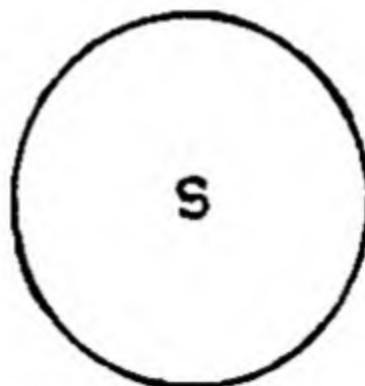
(iii) Some S is all P



(iv) Some S is some P



(v) No S is any P



A term is said to be **distributed** when it refers to the whole of its extension, **undistributed** when it refers only to part of its extension.

A distributes Subject only.

E ,, both Subject and Predicate.

I ,, neither Subject nor Predicate.

O ,, Predicate only.

By **Quantification of the Predicate** is meant adding a mark of quantity to the predicate as well as the subject of a proposition. This gives us *eight* instead of *four* forms of propositions. (See above). This theory is associated with the name of **Hamilton** and was also adopted by **Jevons** and **Thomson** (with modifications). It is, however, worthless, since it rests on a basis which is psychologically false. It is not true that in our thought we take the predicate of a proposition in extension. We rather think of its attributive meaning or intension—not of extension. Moreover, the four additional forms are superfluous, as—

U is reduced to two A's.

Y ,, ,, A.

Y ,, ,, O.

w is truistic, ∴ useless.

BOOK III.

INFERENCE.

CHAPTER I.

KINDS OF INFERENCE.

Judgment and Inference.—We think by means of judgments, which have always a reference to reality. Some facts may be discovered directly by perception, while others may be discovered through those previously known. In the former case we perceive, in the latter we infer. Thus when we arrive at a truth through other truths with which we are already familiar we are said to infer. In other words, inference is, in its widest sense, the establishment of a judgment by means of other judgments, the discovery of the unknown through the known,* or the explication of the implications of a judgment. Inference may be regarded as a completely developed judgment. A judgment never actually exists in isolation. It is intimately connected with other judgments. Our mind passes from one to the other imperceptibly, but a psychological analysis of this simple process reveals the fact that each judgment is based on other judgments which exist in it implicitly. Our thinking begins with simple judgments, which become more and more articulated and developed as our thought progresses. Inference is

* For a discussion on this point refer to Ch. X below.

more complex than judgment since it involves more than one judgment. Judgment cannot be split into any real elements, but Inference contains judgments as its steps or stages, and involves the passage of the mind from one judgment to another. When such passage is *direct* we have **immediate inference**, but when a third judgment is required as a means of passing from one to the other we have **mediate inference**. While judgment has a *direct* reference to reality, Inference has an *indirect* reference through judgment.

The word Inference is rather ambiguous. It means the *process* as well as the *product* or result of inferring. Logic is not concerned with Inference as a *mental process* : it is Psychology that analyses the state of such mental activity. Logic takes account of *Inferences*, not of the process of *Inference* or *Reasoning*. Formal Logic considers only the *validity* (and not necessarily the *truth*) of inferences. If one proposition is taken as valid, no matter whether it is true or false, its validity will serve as the basis of accepting or rejecting the propositions which follow from it. A proposition may not be *true*, but all the same it can be accepted as formally *valid* if it is free from any inner contradiction.

2. Kinds of Inference.—Inference is either Inductive or Deductive. The former starts with particular truths and through them discovers more general truths, e.g. 'This, that and other magnets attract iron ; therefore all magnets attract iron.' The latter starts with a general truth and arrives at a more particular truth, e.g., 'All poets are imaginative,' 'Kalidasa

was a poet ;' therefore, 'Kalidasa was imaginative.' Thus, **Inductive Inference** is the procedure from the particular to the universal ; it leads to the discovery of a new proposition which is more general than the original ones ; while **Deductive Inference** is the procedure from the universal to the particular ; it arrives at a proposition less general than the original one.

There are, again, two kinds of Deductive Inference viz., **Immediate Inference** and **Mediate Inference**. In **Immediate Inference** * we pass directly or immediately from one proposition to another. We start with a single proposition and on reflecting on the relation of its terms immediately draw another proposition from it. For instance, from the truth of A proposition we can, at once, infer the truth of I proposition. If 'All kings are happy' is true, then 'Some kings are happy' must also be true. On the other hand, in **Mediate Inference** (whose principal type is the **Syllogism**) we put together two propositions and arrive at a third. The agreement or disagreement of the two terms is asserted, after each is compared with a middle term i.e., the element common to both.

Thus :—

All M is P
All S is M
∴ All S is P.

The conclusion 'S is P' is arrived at meditately, i.e., through the medium of M, the middle term, with which

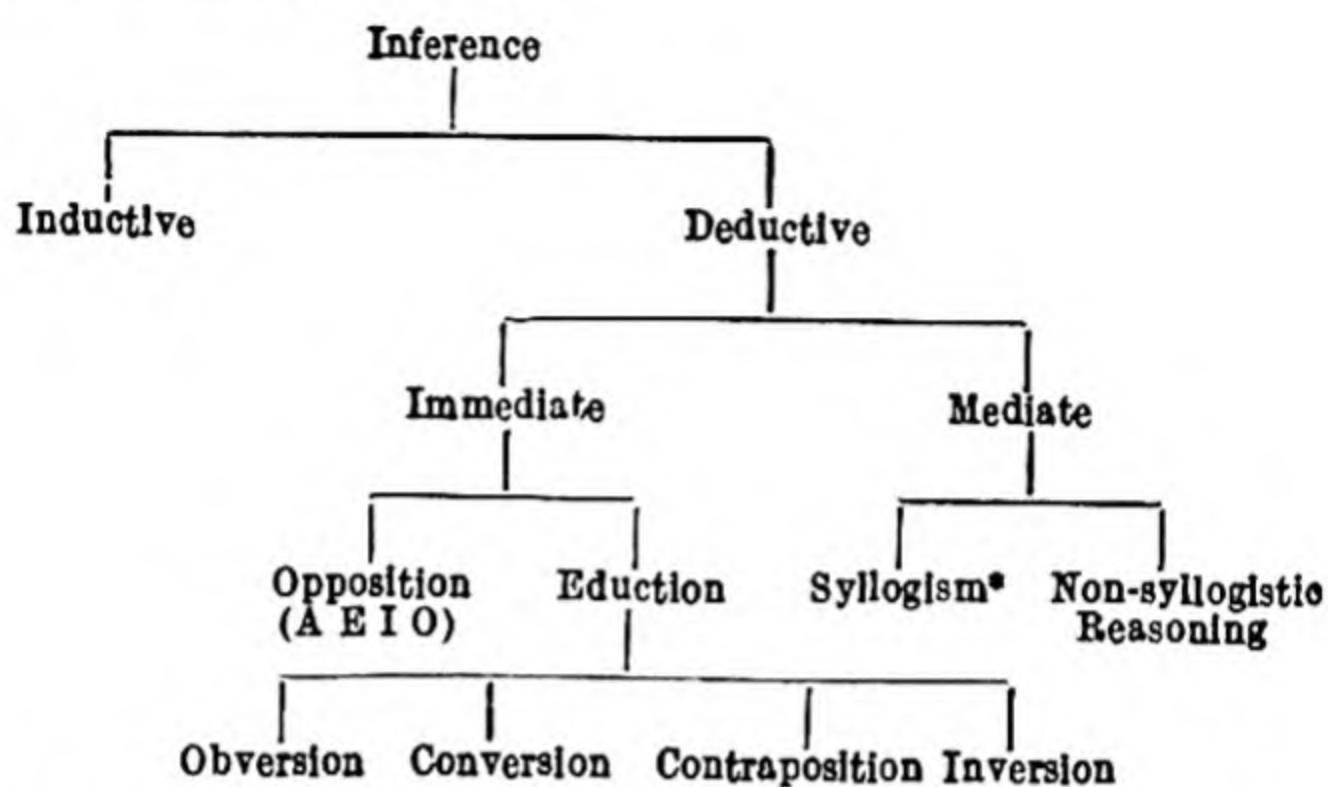
* Mere translation into logical form or re-wording of a proposition is not Immediate Inference, e.g., 'Sweet are the uses of adversity = The uses of adversity are sweet.'

both S and P are compared. This procedure requires at least two propositions, which must be put together and compared before the third proposition is inferred from them. The first two are called 'premisses' and the last one 'conclusion.'

As to Immediate Inference, some logicians question its right to be called Inference at all, since it involves a mere change in the verbal expression. By a mere verbal manipulation of the proposition 'All S is P' we arrive at 'Some P is S.' But even such verbal manipulation is useful, as it brings out clearly the various implications of the original proposition. The truth is that this procedure involves more than mere verbal manipulation. It involves a certain amount of reflection as well.

Immediate Inference may be considered under two headings: (1) Opposition of Propositions, and (2) Eduction of Propositions. In the first case, we infer from the truth or falsity of one proposition the truth or falsity of other propositions having the same subject and predicate. In other words, 'Opposition' means the relations which exist between the four logical forms of propositions, A, E, I, O. In the other case, *viz.*, in Eduction, we start with a given proposition and derive immediately other propositions implied by it. We look at the given proposition from different points of view and express the same meaning in different forms. Under 'Eduction' we shall consider the forms, known as 'Obversion,' 'Conversion,' 'Contraposition,' and

‘Inversion.’ The following scheme shows the various kinds of Inferences:—



The next three chapters will treat of Immediate Inference, and the remaining ones of Mediate Inference.

SUMMARY.

Inference is the establishment of a judgment by means of other judgments. It is a completely developed judgment. When the full meaning of a judgment is drawn out, we have Inference. Judgment is the unit of thought, while Inference contains judgments as its steps. Judgment refers to reality *directly*, Inference does so *indirectly*.

Inference is the passing of the mind from one judgment to another. When this is done directly or

* Some hold the Syllogism to be the only form of mediate inference; all other forms to be reduced to it. Doubtless it is the principal form, but there are non-syllogistic arguments as well. These are discussed in Ch. VII below.

immediately, we have **Immediate Inference**; otherwise when we pass from one judgment to another through the medium of a third, we have **Mediate Inference**.

Inference may be **Inductive** (from the particular to the more general) or **Deductive** (from the general to the more particular). The latter may be **Immediate** when a proposition is inferred directly from the other or **Mediate** (usually identified with the **Syllogism**), consisting of three propositions, one of which is inferred by putting together the other two.

Immediate Inference has two branches:—

- (i) Immediate Inference through the Opposition of Propositions A, E, I, O.
- (ii) Immediate Inference by (a) Obversion,
(b) Conversion, (c) Contraposition, and
(d) Inversion—which are known as **Educations**.

CHAPTER II.

OPPOSITION OF PROPOSITIONS.

1. **Opposition defined.**—The term ‘Opposition’ is used in Logic in a technical sense.* Two propositions are logically *opposed* when they have the same subject and predicate but differ in quantity, quality or both. Thus they differ in their logical form but refer to the same matter. Opposition means, therefore, the mutual relation of the four propositions A, E, I, O.

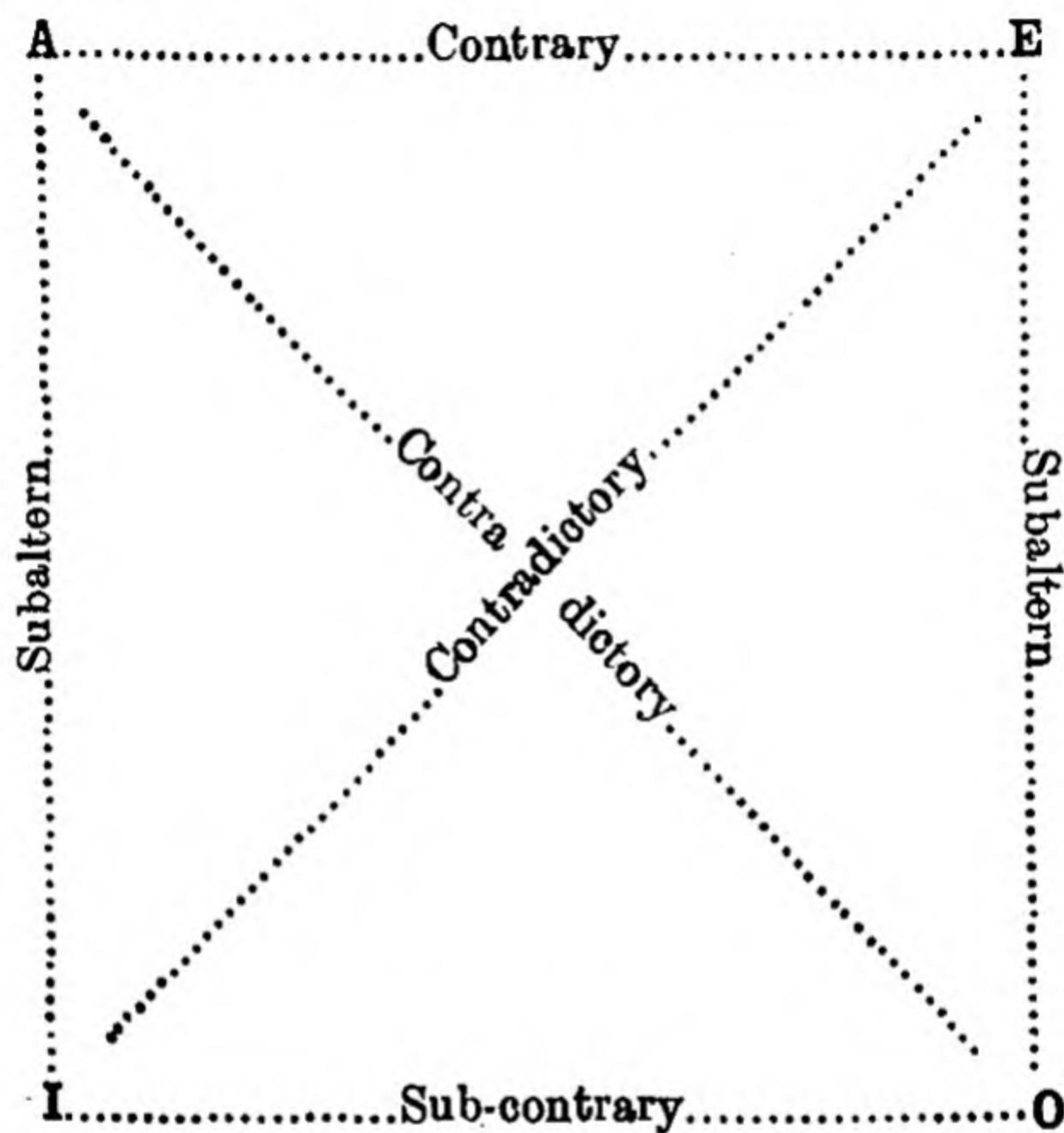
2. **Kinds of Opposition.**—The mutual relation of the four forms gives us **Four kinds of Opposition**:

(a) Between A and O } Contradictory Opposition.
 or ,,, E and I }
 (b) Between A and E : Contrary ,,
 (c) Between I and O : Sub-contrary ,,
 (d) Between A and I } Subaltern ,,
 or ,,, E and O }

Thus A and O, or E and I are Contradictories, A and E are Contraries; I and O are Sub-contraries; A and I, or E and O are Subalterns. The first kind is an Opposition between a universal and the particular of the opposite quality, the second between two uni-

* Otherwise it cannot apply to the relation between A and I, E and O, known as *Subalternation*. Mansel, Ueberweg and others, exclude it from *Opposition*. Keynes, however, adds: "Though it might be possible to find a more convenient term, I do not think that any confusion is likely to result from the use of the term *opposition* if the student is careful to notice that it is here used in a technical sense." (op. cit., p. 55 note.)

versals of opposite quality, the third between two particulars of opposite quality, and the fourth between a universal and the particular of the same quality. These relations may be diagrammatically represented in the following scheme, known as the **Square of Opposition**:—



The terms 'contrary' and 'contradictory' have already been introduced. Besides these, the terms 'sub-contrary' and 'subaltern' are now introduced. I and O are called *sub-contrary*, because they are placed under the contraries A and E, which are their respective universals. A includes I, and E includes O, as a genus includes its species. This relation is indicated by

placing I under A, and O under E, in the Square of Opposition. A and I, E and O are called *subaltern*, because in each pair one is placed under the other or subordinated to it.

3. **Laws of Opposition.**—They are as follows :

(i) **Contradicaries** : One must be true and the other false.

(ii) **Contraries** : Both cannot be true but both may be false.

(iii) **Sub-contraries** : Both may be true, but both cannot be false.

(iv) **Subalterns** : The truth of the universal includes that of the particular, but not *vice versa*.

The following scheme summarises these relations and their laws :—

		If one is	The other is
Contradiction.	Between A and O	...{ True False	... False ... True
	Between E and I	...{ True False	... False ... True
Contrariety.	Between A and E	{ True False	... False ... Doubtful
	Between I and O	{ True False	... Doubtful ... True
Sub-contrariety.			

Subalternation.	Between A and I.	If A is	... { True False }	Then I is	... { True Doubtful }
		If I is	... { True False }	Then A is	... { Doubtful False }
Between E and O.	If E is	... { True False }	Then O is	... { True Doubtful }	
		If O is	... { True False }	Then E is	... { Doubtful False }

The following table shows all the inferences obtainable by opposition :—

Given		A	E	I	O	
1	A true	...	...	false	true	false
2	A false	...	...	doubtful	doubtful	true
3	E true	...	false	...	false	true
4	E false	...	doubtful	...	true	doubtful
5	I true	...	doubtful	false	...	doubtful
6	I false	...	false	true	...	true
7	O true	...	false	doubtful	doubtful	...
8	O false	...	true	false	true	...

The legitimacy of these inferences depends on the three Fundamental Laws of Thought (*vide supra*).

It may be said that the inferences which are 'doubtful' in this scheme point out the inadequacy of mere formal analysis. It is one of the failures of Formal Logic to be compelled to admit certain inferences as 'doubtful' or 'unknown' or 'contingent.'

Contradictory Opposition is the most perfect form of opposition. To deny the truth of a proposition is the same as to affirm the truth of its contradictory and *vice versa*. While rebutting an adversary's argument in a debate, a 'contradictory' proposition will prove more powerful than a 'contrary.' Thus 'All S is P' can be rebutted more easily by 'Some S is not P' than by 'No S is P.' The contradictory proposition can be proved more easily than the contrary, and it also effects rebuttal of the universal proposition advanced by the other side. Contrary Opposition is more than mere denial. It affirms something as far as possible removed from the original assertion. When contrary opposition is confused with the contradictory, we have an example of the fallacy known as **False Opposition**. This fallacy is committed whenever the rules of opposition are in any way violated.

4. Typical Examples.—The following examples will bring home the meaning of opposition:—

- (1) Give all the logical "opposites" of the proposition: 'All poets are musicians.'

This proposition is in A form, hence its
 Contradictory : 'Some poets are not musicians' . . O
 Contrary : 'No poets are musicians' . . E
 Subaltern : 'Some poets are musicians' . . I

(2) Proposition : 'A stitch in time saves nine.'

Singular propositions are treated as Universal,
 hence this proposition is a universal affirmative
 for logical purposes.

Contradictory : 'Some stitches in time do not save
 nine' O
 Contrary : 'No stitch in time saves nine' . E

Both these forms are false, if the original
 proposition is true.

(3) Proposition : 'Some students are not ath-
 letes' (O).

Contradictory : 'All students are athletes' A (false).
 Sub-Contrary : 'Some students are athletes' I (doubtful)
 Subaltern : 'No students are athletes' E (doubtful).

(4) Proposition : 'No women are soldiers' (E).

Contradictory : 'Some women are soldiers' I (false)
 Contrary : 'All women are soldiers' A (doubtful)
 Subaltern : 'Some women are not sol-
 diers' O (true).

(5) Proposition : 'None but the intelligent
 succeed.'

= 'None who are not intelligent succeed'
 (E).

Contradictory : 'Some who are not intelli-
 gent succeed' . . . I (false)
 Contrary : 'All who are not intelligent
 succeed' . . . A (false).

(6) Proposition : 'Some Greeks are musicians.'
(I).

Contradictory : 'No Greeks are musicians' E (false)

Sub-contrary : 'Some Greeks are not musicians' . . . O (doubtful)

Subaltern : 'All Greeks are musicians' A (doubtful)

5. Opposition of Singular Propositions.—Contrariety is not possible in the case of singular proposition, since we cannot then go beyond the contradictory. For instance, take the singular proposition 'Spinza is a pantheist.' Its contradictory is 'Spinza is not a pantheist.' Keeping the same S and P it is impossible to go beyond this denial. Its contrary should be an assertion beyond this denial—which is not possible. The contradictory and the contrary are the same in this case. This opposition of singulars is called **Secondary Opposition**.

6. Opposition of Hypothetical and Disjunctive Propositions.—Opposition applies to any propositions, which have the same terms but which differ as to quantity or quality. As distinctions of quantity and quality apply to Hypothetical propositions, it follows that Opposition will also apply to them. In their case, the four logical forms will be as follows :—

A : If A is B, C is D

E : If A is B, C is not D

I : In some cases in which A is B, C is D

O : In some cases in which A is B, C is not D

The relation between these propositions A, E, I, O is the same as in the case of Categorical Propositions.

But in Disjunctive propositions the distinctions of quality do not exist, hence Opposition is not applicable to them.

SUMMARY.

Two propositions are said to be opposed when they are identical in matter but different in form. In other words, the **Opposition of Propositions** means the relation between any two propositions having identically the same subject and predicate.

Four kinds of Opposition :—

- (1) **CONTRADICTION** : Between A and O
or Between E and I.
- (2) **CONTRARY** : Between A and E
- (3) **SUB-CONTRARY** : Between I and O
- (4) **SUBALTERN** : Between A and I
or, Between E and O.

Contradictory Opposition exists between two propositions which have the same subject and predicate but differ both in quantity and quality. It is the most perfect of all forms of Opposition, since contradictories are incompatible both as to their *truth* and *falsity*.

Contrary Opposition exists between two universal propositions of opposite quality. Each contrary denies the entire truth and asserts the entire falsity of the other in all its parts, by setting up a counter-assertion as far removed as possible from the latter.

Sub-contrary Opposition exists between two particular propositions of opposite quality. Sub-contraries

cannot be false together. One of them **MUST** be true, and both of them **MAY** be true.

Subaltern Opposition exists between a universal and the particular of the same quality.

Laws of Opposition :—

- (1) **Contradictory** : One must be true, the other false,
- (2) **Contrary** : Both cannot be true, but both may be false.
- (3) **Sub-contrary** : Both may be true, but both cannot be false.
- (4) **Subaltern** : If the universal is true, the particular must be true, but not *vice versa*.

The following Table summarises all the inferences obtainable from the **Square of Opposition** :—

- (1) If A is true : I is true, E and O are false.
- (2) If A is false : O is true, E and I are doubtful.
- (3) If E is true : O is true, A and I are false.
- (4) If E is false : I is true, A and O are doubtful.
- (5) If I is true : E is false, A and O are doubtful.
- (6) If I is false : A is false, E and O are true.
- (7) If O is true : A is false, E and I are doubtful.
- (8) If O is false : E is false, A and I are true.

Singular Propositions have no formal contraries but only contradictories.

The violation of the Laws of Opposition resulting in many kinds of wrong inferences, is known as the fallacy of False Opposition.

CHAPTER III.

EDUCTIONS OF PROPOSITIONS.

1. Opposition and Eduction.—In the last chapter we described one form of Immediate Inference and now we proceed to deal with the other. The first form, *viz.*, Opposition, is in a way the meeting-point of the second and third parts of Logic. Some authors are of opinion that Opposition is concerned primarily with the mutual relations of the four fundamental propositions, hence it must be considered under "Propositions." Others hold that Opposition is not a mere verbal manipulation of terms but implies a movement of thought, hence its treatment must be placed under Immediate Inference. This is after all a difference of standpoint.

We have already defined Immediate Inference as the process of analysing or making explicit the various implications of a proposition. The propositions which express these new items of knowledge are called Immediate Inferences. Some of these inferences have already been treated under "Opposition." Propositions were said to be opposed when they had the same subject and predicate but were different in form. But it is also possible to derive from a proposition accepted as true several other true propositions, by allowing a change in the terms and in the original order. These new forms of Immediate Inference are called **Eductions**.* In Opposition the subject and the predicate remain unaltered while their quantity, quality, or both may

* This name, introduced by Miss Constance Jones of Cambridge, is now commonly employed in logical treatises.

be changed. Some may be true, some may be false, some may be unknown or doubtful. In Eduction, however, the subject and the predicate are not exactly the same terms as in the original proposition accepted as true; neither are they in the same order; but the original terms or their negatives may appear in various orders. Moreover, when a proposition is given as true, its 'eductions' must also be *true*. Eduction, therefore, be defined as the process by which, from any proposition, accepted as true, others implied in it are derived, differing from it in subject, in predicate, or in both. Eductions are those forms of immediate inference in which the new proposition differs from the original in subject, or predicate, or both. The truth of the new proposition is necessarily implied in that of the original

2. **Kinds of Eductions.**—A categorical proposition has two terms \bar{S} and \bar{P} ; but as each of these terms has its conceivable negative not- S and not- P (usually denoted by \bar{S} and \bar{P}), every proposition suggests four terms S , P , \bar{S} and \bar{P} . We have, then, to find out how many legitimate predications can be made about S or \bar{P} in terms of P or \bar{P} , and how many about P or \bar{P} in terms of S and \bar{S} . The following scheme exhibits all such inferences with their technical names:—

ORIGINAL PROPOSITIONS. : $S-P$	
Its <i>Obverse</i>	: $S-\bar{P}$ by the process Obversion .
„ <i>Converse</i>	: $P-S$ „ „ Conversion .
„ <i>Obverted Converse</i>	: $P-\bar{S}$
„ <i>Contrapositive</i>	: $\bar{P}-S$ „ „ Contraposition
„ <i>Obverted Contrapositive</i>	: $\bar{P}-\bar{S}$
„ <i>Inverse</i>	: $\bar{S}-P$ „ „ Inversion .
„ <i>Obverted Inverse</i>	: $\bar{S}-\bar{P}$

It will be noticed that of the inferences in the above list the converse, the contrapositive and the inverse (in addition to the original proposition) have a positive predicate, while the remaining forms have a negative predicate. Of each of the four pairs one form is obtainable from the other by the process called *Obversion*. Thus we arrive at the following four kinds of educutions :—

- (i) **Obversion** : when the predicate of the original proposition is negated, while the subject remains unchanged. Thus, SaP—Se \bar{P} .
- (ii) **Conversion** : when the terms of the original proposition are transposed. The subject and predicate of the one becomes, respectively, the predicate and subject of the other. Thus, SeP—PeS.
- (iii) **Contraposition** : when the subject of the inferred proposition is the contradictory of the original predicate ; e.g., SaP— \bar{P} eS.
- (iv) **Inversion** : when the subject of the inferred proposition is the contradictory of the original subject, e.g., SaP— \bar{S} oP.

Some of these inferences, especially those involving the negative terms \bar{S} , \bar{P} will appear as unnatural modes of expression. None the less they possess their logical value in so far as they exhaust the implications of the original predication. We shall now speak of each of the four kinds of Educutions separately.

3. **Obversion.***—This is the process of inferring from a given proposition, called the *Obvertend*, another proposition, called the *Obverse*, by changing the quality of the original proposition and replacing the predicate by its contradictory. This change does not affect the meaning at all. It expresses an affirmative proposition in a negative form, and *vice versa*.

Every affirmation implies the negation of its opposite, and to deny a negative is to affirm, since two negatives make one affirmative. Obversion is based on this principle. The Obversion of Affirmatives rests on the Law of Contradiction, and of Negatives on the Law of Excluded Middle.

The following is the **Rule of Obversion** :—

(*Negative the predicate and change the quality of the proposition, leaving its quantity unaltered.*)

The application of this Rule yields the following results:

<i>Obvertend.</i>		<i>Obverse.</i>	
A	All S is P	No S is not-P	E
E	No S is P	All S is not-P	A
I	Some S is P	Some S is not not-P	O
O	Some S is not P	Some S is not-P	I

* Other names, now more or less obsolete, are Infinitation, Equipollence, Permutation, Immediate Inference by Privative Conception, Contraversion, etc.

Examples of Obversion—

Original proposition

Obverse.

SaP: 'All men are mortal' SeP: 'No men are not-mortal.'

SeP: 'No men are giants' SaP: 'All men are not-giants.'

SiP: 'Some princes are just' SoP: 'Some princes are not not-just.'

SoP: 'Some men are not wise' SiP: 'Some men are not-wise.'

If we again obvert the obverse of a given proposition, we arrive at the original proposition itself. Thus Obversion is a reciprocal process.

4. Conversion.—Conversion is the process of deriving one proposition from another by transposing the original terms. The original proposition is called the *convertend*, the inferred proposition the *converse*. The subject and predicate of the convertend become respectively the predicate and subject of the converse.

To ensure the validity of this form of inference the following rules must be observed:—

Rule 1. *No term must be distributed in the converse which was not distributed in the convertend.*

Rule 2. *The quality of the proposition must remain unchanged.*

The meaning of a proposition must never change in the process of conversion. Hence, if the original proposition gives us information about a part and not the whole, i.e., if it contains an undistributed term, we must not assume such knowledge as is not already implied; in other words, the undistributed term must

not be distributed in the converse. This requirement is, in fact, the most fundamental characteristic of all formal inference. This rule also points out that conversion is not always the *mere* transposition of terms. (A change in quantity is sometimes necessary.) For instance, in SaP the subject is distributed while the predicate is not. Hence in transposing the terms, we must not 'distribute' P (which will become the subject of the converse), as it is 'undistributed' in SaP. Thus the converse of this proposition cannot be PaS but PiS.

The meaning of the second rule too is obvious. The converse has the same terms as appear in the original proposition, except that they are transposed. Hence if the convertend is an affirmation or denial, the converse must also be respectively an affirmation or denial. A negative cannot be immediately inferred from an affirmative and *vice versa*. Prof. Welton* proves this rule by the statement that as the converse simply makes the same assertion as the convertend, looked at, as it were, from the other side, it is clear that the *quality* of both propositions will be the same.

Kinds of conversion :—There are two kinds of conversion : (i) **Simple** and (ii) **By limitation or *per accidens***. A proposition is said to be converted **simply** when its quantity remains unchanged in the converse. Obviously those propositions only can be converted **simply** whose subject and predicate have the same quantity. Such propositions are E and I. On the

* *cf.* Welton, *Manual of Logic*, Vol. I, p. 256.

other hand, a proposition is said to be converted by **limitation*** or **per accidens** when its quantity is limited or reduced in the converse. In this case the original proposition is 'universal' and its converse is 'particular.' In the proposition 'All S is P,' S is distributed and P is undistributed. By the *mere transposition* of terms we have 'All P is S,' but this cannot be the true converse, as it distributes P, which, as the original predicate, was undistributed in the original proposition. Hence we *limit* the extent to which the original subject is affirmed of the original predicate: thus 'All S is P' is converted into 'Some P is S.' Again, the relation of a predicate to its subject may be *essential* or *accidental*. If it is essential we have simple conversion. If it is not essential it must at least be *accidental*, in which case P will be an accident of S, and, therefore, we must change the quantity. For this reason conversion by limitation is also called conversion *per accidens*. Mr. Joseph† adds: "Even when the predicate is known to be of the essence of the subject, we must convert *per accidens*, if the predicate is the genus: e.g., 'All men are animals'—'Some animals are men.'"

Let us now apply the rules of conversion to the four fundamental forms of propositions:—

(a) **Conversion of A.**—Take the proposition SaP. Here S is distributed, P is not. If we convert it into PaS

* This kind of conversion was called 'Partition' by Aristotle. It is not a reciprocal process, while simple conversion is so.

† *c.f.* Joseph, *op. cit.* p. 212.

we break the first rule : we distribute P in the converse, although in the original proposition P was undistributed. This results in the fallacy of *Illicit Conversion*.* Hence the true converse of SaP is PiS. Sometimes the simple converse of SaP into PaS may be true, but its truth is not derived from conversion as such. It has to be proved independently. For example ; 'Every equiangular triangle is equilateral' is as true a proposition as is 'Every equilateral triangle is equiangular.' But its truth has to be established by a separate and independent demonstration ; it cannot be inferred from the latter proposition by conversion : The converse of SaP is PiS ; i.e., A converts to I.

(b) **Conversion of E.**—This offers no difficulty. SeP is converted simply into PeS. It is not necessary to change the quantity in this case. Both S and P. are distributed in SeP, and the same is the case in PeS. Thus no rule is violated in this simple conversion of E into E.

(c) **Conversion of I.**—Like E, I also converts SIMPLY. In SiP both S and P are undistributed, hence by its simple conversion into PiS—which also distributes neither of its terms—we break no rule. Thus I converts simply into I.

(d) **Conversion of O.**—In the case of an O proposition conversion is not possible, since in it the subject is undistributed and the predicate is distributed.

* Converting a proposition in such a way that a term undistributed in the original proposition is distributed in the converse is called the Fallacy of Illicit Conversion. Obviously it applies to the conversion of and O only.

But if we convert *SoP* into *PoS* we must distribute the predicate of the converse, *viz.*, S. But this is impossible, as S was undistributed in the convertend. Thus O is *inconvertible*.

We may sum up the results by saying that A converts *per accidens*, E and I convert *simply*, and O is *inconvertible*. Thus:—

Convertend.		Converse.	
A	All S is P	Some S is P	I
E	No S is P	No P is S	E
I	Some S is P	Some P is S	I
O	Some S is not P	(None)	

Examples of Conversion.

1. All Philosophers are thoughtful men.
 \therefore Some thoughtful men are philosophers.
2. All Parisians are pleasure-loving.
 \therefore Some pleasure-loving people are Parisians.
3. Energy commands success.
 $=$ All energetic persons are successful.
 \therefore Some successful persons are energetic.
4. Some Frenchmen are mathematicians.
 \therefore Some mathematicians are Frenchmen.
5. No painters are poets.
 \therefore No poets are painters.

6. The poor are deserted by their friends.

∴ Some persons who are deserted by their friends are poor people.

7. Some men are not wise.

(No converse.)

8. Some crystals are not regular.

(No converse.)

9. All philosophical books are not easy to understand.

(No converse.)

10. Night is followed by day.

∴ Something that is followed by day is night.

11. No students are smokers.

∴ No smokers are students.

12. Well begun is half done.

=All things well begun are half done.

∴ Some things half done are well begun.

13. No Punjabis are cowards.

∴ No cowards are Punjabis.

14. Not all despots are cruel.

=Some despots are not cruel.

(No converse.)

15. All tyrants are unhappy.

∴ Some unhappy persons are tyrants.

16. Indians alone are economical.

=No non-Indians are economical, or

All who are economical are Indians.

The first form converts into 'No one who is economical is non-Indian.'

The second form converts into 'Some Indians are economical.'

17. No woman is now hanged for any offence in the more civilized countries.

∴ No one now hanged for any offence in the more civilized countries is a woman.

18. All that glitters is not gold.

=Some glittering things are not gold.
(No converse.)

19. X struck Y.

∴ Some person who struck Y is X.

20. All air contains nitrogen.

∴ Something that contains nitrogen is air.

(It is necessary that a proposition should always be expressed in its strict logical form before being converted, otherwise mistakes are bound to occur.)

In the **Conversion of Singular Propositions** the same rules as apply to universal propositions are observed. Affirmative Singular propositions are converted **per accidens**, while negative singular propositions are converted **simply**. For instance, 'Buddha was a great reformer' converts into 'A great reformer was Buddha'; 'Newton was not a philosopher' converts into 'No philosopher was Newton.' If both terms of a proposition are singular, it can be converted **simply** if it is affirmative, and it is **inconvertible** if it is negative. Thus 'Delhi is the Capital of India' converts into 'The Capital of India is Delhi.' 'Calcutta is not the Capital of India' cannot be converted.

Obverted Converse.—A new inference is obtained if the *converse* of a proposition is further *obverted*. For example :—

Original Proposition : A—All musicians are artists.

Converse : I—Some artists are musicians.

Obverted Converse : O—Some artists are not non-musicians

Original Proposition : E—No students are lawyers.

Converse : E—No lawyers are students.

Obverted Converse : A—All lawyers are not-students.

Original Proposition : I—Some Indians are cosmopolitans.

Converse : I—Some cosmopolitans are Indians.

Obverted Converse : O—Some cosmopolitans are not non-Indians.

This process cannot apply to O which is inconvertible.

5. Contraposition.—The two processes, *viz.*, Obversion and Conversion, are known as Primary or Simple forms of immediate inference. Besides these, there are other modes called Secondary or Compound, because they are obtained by combining the Primary forms of Obversion and Conversion. The best known of these is **Contraposition**,* which is the converse of the obverse of the original proposition. It may be defined as that process of immediate inference by which from a given proposition we infer another (called the Contrapositive) whose subject is the contradictory of the original predicate.

* Contraposition was first invented by Boethius, about 500 A.D.

The rule of contraposition may be stated thus :—

First obvert, then convert.

The application of this rule will show that contraposition changes the *quality* of a given proposition, because obversion first changes its quality, and then conversion does not change it back. But the *quantity* of the original proposition is not affected by this process, except in the case of E. E obverts to A, but A cannot be converted *simply* but *per accidens* (which involves a change in quantity). Then again, we can obvert I into O, but O is *inconvertible* ; hence I cannot have any contrapositive.

Some logicians consider Contraposition as a form of Conversion, and give it the name of **Conversion by Negation** or **Conversion by Contraposition**, since O which could not be converted either *simply* or *per accidens* could be converted *by negation*. They speak of contraposition as the obverted form of the conversion by Negation. But we shall take contrapositive to mean the **Converted Obverse** of a given proposition, and the form obtained by further obverting the contrapositive may be called the **Obverted Contraposition**.* In the obverted contrapositive the quality is again changed, so that we have the same quality as the original

* For this reason some older logicians reserve the name contraposition for our 'observed contraposition.' It is the latter form alone that follows the rule of conversion that the *quality* remains unchanged.

proposition.* The subject of this form of inference is the negative of the original predicate, and the predicate is the negative of the original subject. The fallacy of **Illicit Contraposition** is committed when the contrapositive contains a distributed term which was originally undistributed.

The following table exhibits the results symbolically :—

1	Original Proposition	...	SaP	SeP	PiS	SoP
2	[Obverse of (1)]	...	Se \bar{P}	Sa \bar{P}	So \bar{P}	Si \bar{P}
3	CONTRAPOSITIVE [i.e., Converse of (2)]	...	\bar{P} eS	\bar{P} iS	(None)	\bar{P} iS
4	OBVERTED CONTRAPOSITIVE [i.e., obversion of (3)]		Pa \bar{S}	\bar{P} o \bar{S}	(None)	\bar{P} o \bar{S}

Examples of Contraposition :—

Original Proposition : A : All Professors are teachers.

Contrapositive : E : No non-teachers are Professors.

Obverted Contrapositive : A : All non-teachers are not-Professors.

Original Proposition : E : No crows are white.

Contrapositive : I : Some not-white things are crows.

Obverted Contrapositive : O : Some not-white things are not not-crows.

Original Proposition : O : Some offenders are not punished.

Contrapositive : I : Some unpunished persons are offenders.

Obverted Contrapositive : O : Some unpunished persons are not non-offenders.

As remarked above, I has no contrapositive, since after obverting to O it is inconvertible.

* What we call *contraposition* is, for instance, called *conversion by negation* by Mr. Joseph and what we call *obverted contraposition* is called *contraposition* by him. There is no likelihood of any confusion if this difference in usage is noted. Dr. Coffey uses the term "Partial Contrapositive" for our "contrapositive," and "Full contrapositive" for our "Obverted contrapositive."

6. **Inversion.**—Inversion is that process of immediate inference by which from a given proposition we infer another whose subject is the contradictory of the original subject. The original proposition is called the *invertend* and the derived one the *inverse*. In this mode of inference there is no transposition of terms but there is a change of quality, both in its subject and in the proposition itself.* The Inverse of a proposition is arrived at by a repetition of Obversion and Conversion.

(i) *Inversion of A.*—There are two ways in which we may proceed. We may either begin with obversion or with conversion. Thus taking the proposition SaP we proceed in both the ways :—

Original Proposition :	SaP	Original Proposition :	SaP
By Obversion :	Se \bar{P}	By Conversion :	P \bar{S}
By Conversion :	$\bar{P}eS$	By Obversion :	Po \bar{S}
By Obversion :	$\bar{P}a\bar{S}$	By Conversion :	—
By Conversion :	$\bar{S}i\bar{P}$		
By Obversion :	$\bar{S}oP$		
By Conversion :	—		

Our first step is obversion in the left-hand column and conversion in the right-hand one. Beginning with obversion we have been able to take five steps, and find $\bar{S}i\bar{P}$ and $\bar{S}oP$ as two Inverses. But $\bar{S}oP$ cannot be

* “Although the Inverse is one form, Inversion is not one process, but is obtained by different processes from E and A respectively. In this it differs from Obversion, Conversion and Contraposition, each of which stands for one process”—Carveth Read, *Logic*, 2nd ed., p. 89.

converted further. Under the other column we start with conversion and can take only two steps, since the form $Po\bar{S}$ is inconvertible. Thus the original proposition SaP gives us two Inverses only, *viz.*, $\bar{S}i\bar{P}$ and $\bar{S}oP$. To infer $\bar{S}eP$ from SaP is to commit the fallacy of **Illicit Inversion**.

(ii) *Inversion of E*.—In the same way we proceed with the inversion of E, taking either obversion or conversion as our first step.

Original Proposition SeP Original Proposition SeP

Obverts to	$Sa\bar{P}$	Converts to	PeS
Converts to	$\bar{P}iS$	Obverts to	$Pa\bar{S}$
Obverts to	$\bar{P}oS$	Converts to	$Si\bar{P}$
		Obverts to	$\bar{S}o\bar{P}$

(No further conversion of O) (No further conversion of O)

The subject of the Inverse is always \bar{S} . We do not get any such form if we begin with obversion as our first step. By the other route, however, we arrive at two Inverses $\bar{S}iP$ and $\bar{S}o\bar{P}$. To infer $\bar{S}aP$ from SeP is to commit the fallacy of **Illicit Inversion**.

(iii) *Inversion of I*.—The Inverse of I propositions is not possible, as will be evident from the following procedure :—

Original Proposition $Si\bar{P}$
Obverts to $So\bar{P}$
(which is inconvertible).

Original Proposition SiP
Converts to PiS
Obverts to PoS
(which is inconvertible).

By neither of the two ways do we arrive at any proposition with \bar{S} as subject. Hence there is no Inverse of I.

(iv) *Inversion of O*.—This is also impossible, as by itself it is inconveritble and by a combination of obversion and conversion also we do not obtain any inference with \bar{S} as its subject. Thus :—

Original Proposition	S_oP	Original Proposition	S_oP
Obverts to	$S_i\bar{P}$		(conversion impossible).
Converts to	$\bar{P}iS$		
Obverts to	$\bar{P}o\bar{S}$		

(which is inconveritble).

Hence we arrive at the following results :—

(1) Universal propositions alone (A and E) yield Inverses ; Particulars (I and O) do not.

(2) To invert A we must begin by *obverting*, and to invert E we must begin by *converting*.

The rule for Inversion may, therefore, be stated as follows :—

Convert either the Obverted Converse or the Obverted Contrapositive.

We observe that in the Inverse the subject is \bar{S} and the predicate is P. If we further obvert the inverse, we arrive at another form called the **Obverted Inverse**. In this new form the predicate is \bar{P} . Thus :—

Original Proposition :	S_aP	S_eP
Inverse :	\bar{S}_oP	\bar{S}_iP
Obverted Inverse :	$\bar{S}_i\bar{P}$	$\bar{S}_o\bar{P}$

Examples of Inversion :—

I. Original Proposition : \bar{S}_aP : All diligent students are successful.

Obverted Contrapositive : $\bar{P}a\bar{S}$: All not-successful students are not-diligent.

Inverse :	$\bar{S}oP$: Some not-diligent students are not successful.
Obverted Inverse :	$\bar{S}i\bar{P}$: Some not-diligent students are not-successful.
2. Original Proposition	SeP : No unjust cause is victorious.
Inverse :	$\bar{S}iP$: Some just causes are victorious.
Obverted Inverse :	$\bar{S}o\bar{P}$: Some just causes are not non-victorious.

7. **Table of Eductions.***—The results of all the foregoing sections in this chapter may be summarised symbolically as follows :—

	A	E	I	O
Original Proposition	.	.	SeP	SiP
Obverse	.	.	$Se\bar{P}$	$So\bar{P}$
Converse	.	.	PiS	PeS
Obverted Converse	.	.	$Po\bar{S}$	$Pa\bar{S}$
Contrapositive	.	.	\bar{PeS}	\bar{PiS}
Obverted Contrapositive.	.	.	$\bar{Pa\bar{S}}$	$\bar{Po\bar{S}}$
Inverse	.	.	\bar{SoP}	\bar{SiP}
Obverted Inverse	.	.	$\bar{Si\bar{P}}$	$\bar{So\bar{P}}$

8. **Material Eductions.**—The forms of immediate inference considered so far have been of a more or less *Formal* character, and consequently we have been able to represent them symbolically. But there are other modes of inferences which are not so important and whose validity does not depend so much on their *form* as on their *meaning*. Such eductions are incapable of

* For Examples in Systematic Eduction read B. Gibson, *op. cit.* pp. 202—209.

being expressed symbolically. Of these we may note the following :—

(i) **Immediate Inference by Added Determinants** is that process by which we limit the subject and the predicate of a proposition by adding the same qualification to each. Such limitation is called *Determination* and the added qualification is called a *Determinant*. Thus, from 'Negroes are men' we infer that 'All *honest* Negroes are *honest* men'; from 'All Jews are men' we infer that 'All *good* Jews are *good*, etc.' The *added determinant* must have precisely the same meaning in both terms. But the meaning of a word does not always remain precisely the same: it is generally determined by the context. Hence this kind of inference can easily become fallacious, especially when the *determinants* are terms involving a comparison. For instance, from 'An ant is an animal' it does not follow that 'A *large* ant is a *large* animal'; neither does it follow from 'A wrestler is a man' that 'A *bad* wrestler is a *bad* man'; nor from 'An elephant is an animal' that 'A *small* elephant is a *small* animal.'

(ii) **Immediate Inference by Complex Conception**, which is similar to the first, except that whereas in the previous form of inference the subject and predicate of the original proposition were determined by the third, in this inference they rather determine the third term; e.g., from 'Arsenic is poison' we infer that 'A dose of arsenic is a dose of poison,' from 'A Negro is a man' that 'The death of a Negro is the death of a man.' Here again a fallacy may arise. For instance, we cannot

infer from 'A motor-car is not a phaeton' that 'The owner of a motor-car is not the owner of a phaeton,' nor from 'Smokers are men' that 'A majority of smokers are a majority of men.'

(iii) **Immediate Inference by Converse Relation** is the process by which from a given relation of two objects we infer their corresponding converse relation. The terms are transposed and are replaced by their correlative forms. For instance, 'A foot is greater than an inch,' therefore, 'An inch is smaller than a foot;' 'Orpheus was the husband of Eurydice,' therefore, 'Eurydice was the wife of Orpheus;' 'Calais is to the north of Paris,' therefore, 'Paris is to the south of Calais.' This inference is recognised by Aristotle, although some logicians hold that it falls outside the province of Formal Logic.

9. Eductions of Hypothetical Propositions.—The Table of Eductions which applies to Categorical propositions holds good in the case of Hypotheticals as well. This will be obvious, if we state them in their corresponding forms of categorical propositions.

Hypotheticals may assume any of the forms **A, E, I, O.**

A If **A** is **B**, **C** is always **D** = All **AB** is **CD**.

E If **A** is **B**, **C** is never **D** = No **AB** is **CD**.

I If **A** is **B**, **C** is sometimes **D** = Some **AB** is **CD**.

O If **A** is **B**, **C** is sometimes not **D** = Some **AB** is not **CD**.

The Obverse, Converse, Contrapositive and Inverse of Hypotheticals are as follows * :—

(1) Original Proposition : A : If any A is B, then always C is D.

Obverse : E : If any A is B, then never C is not D.

Converse : I : If any C is D, then sometimes A is B.

Contrapositive : E : If any C is not D, then never A is B.

Inverse : O : If any A is not B, then sometimes not C is D.

(2) Original Proposition : E : If any A is B, then never C is D.

Obverse : A : If any A is B, then always C is not D.

Converse : E : If any C is D, then never A is B.

Contrapositive : I : If any C is not D, then sometimes A is B.

Inverse : I : If any A is not B, then sometimes C is D.

(3) Original Proposition : I : If any A is B, then sometimes C is D.

Obverse : O : If any A is B, then sometimes C is not D.

Converse : I : If any C is D, then sometimes A is B.

(4) Original Proposition : O : If any A is B, then sometimes not C is D.

Obverse : I : If any A is B, then sometimes C is not D.

Contrapositive : I : If any C is not D, then sometimes A is B.

* For a detailed account read Welton, *Manual of Logic*, Vol. I, pp. 271—273, and Stock, *Logic*, Ch. XVIII.

10. Eductions of Disjunctive Propositions.—A Disjunctive can at once be changed into a Hypothetical which can further be turned into a Categorical. Thus :

A is either B or C.
 =If A is not-B, it is C.
 =All not-AB is C.

The eductions from Disjunctives do not themselves possess the Disjunctive character. For example—

Original Proposition :	A is either B or C.
Obverse :	No A is both \bar{B} and \bar{C}
Converse :	Some B's or C's are A.
Contrapositive :	Nothing that is both \bar{B} and \bar{C} is A.
Inverse :	Some \bar{A} 's are neither B nor C.

11. Typical Exercises worked out.—We shall now give a few more illustrations to show how the various forms of eduction may be applied to propositions. It must be borne in mind that every proposition should be reduced to its strict logical form before we proceed to draw any immediate inferences, and such reduction should be guided by the *meaning* and not simply by the *form* of the proposition.

(1) **GIVEN** : 'Man can never be happy.'
 =No men are capable of happiness. E.

Obverse : All men are incapable of happiness. A.
Converse : No beings capable of happiness are men. E.
Contrapositive : Some beings incapable of happiness are men. I.

Inverse : Some not-men are capable of happiness. I.

(2) GIVEN : 'Some students are dull.' I.

Obverse : Some students are not not-dull. O.

Converse : Some dull persons are students. I.

Contrapositive : Some dull persons are not not-students. O.

No *Inverse* is possible of I proposition.

(3) GIVEN : 'All uneducated people are superstitious.' A.

Obverse : No uneducated people are not-unsuperstitious. E.

Converse : Some superstitious people are uneducated. I.

Contrapositive : No unsuperstitious people are uneducated. E.

Inverse : Some educated people are not superstitious. O.

(4) GIVEN : 'Some poets are not musicians.' O.

Obverse : Some poets are not-musicians. I.
O is *inconvertible*.

Contrapositive : Some not-musicians are poets. I.
O has no *Inverse*.

(5) GIVEN : 'No cultured persons are prejudiced.' E.

Obverse : All cultured persons are not-prejudiced. A.

Converse : No prejudiced persons are cultured. E.

Contrapositive : Some not-prejudiced persons are cultured. I.

Inverse : Some not-cultured persons are prejudiced. I.

(6) GIVEN : 'All trespassers will be prosecuted.'

=If anyone trespasses, he will be prosecuted. A.

Obverse : If any one trespasses, then never will he be not-prosecuted. E.

Converse : If anyone is prosecuted, then sometimes he will be a trespasser. I.

Contrapositive : If anyone is not prosecuted, then never will anyone be a trespasser. E.

Inverse : If anyone is not a trespasser, then sometimes not will he be prosecuted. O.

(7) GIVEN: 'Few graduates are unmarried.'

=All unmarried graduates are exceptional graduates. A.

Obverse: No unmarried graduates are not-exceptional graduates. E.

Converse: Some exceptional graduates are unmarried graduates. I.

Contrapositive: No not-exceptional graduates are unmarried graduates. E.

Inverse: Some married graduates are not exceptional graduates. O.

(8) GIVEN: 'All players are not competent.'

=Some players are not competent persons. O.

Obverse: Some players are not-competent persons. I.

Contrapositive: Some not-competent persons are players. I.

(9) GIVEN: 'Some prophets are mystics.' I.

Obverse: Some prophets are not not-mystics. O.

Converse: Some mystics are prophets. I.

(10) GIVEN: 'Not all who are called are chosen.'

=Some who are called are not chosen. O

Obverse: Some who are called are not-chosen. I.

Contrapositive: Some who are not chosen are called. I.

SUMMARY.

Eductions are those forms of immediate inference in which the new proposition differs from the original in subject or predicate or in both. In Opposition the same terms were to be used in the same order, but in

Eduction a change is allowed in the form of the terms and in their order. In the latter case the truth of the derived proposition is necessarily implied in that of the original.)

Four kinds of eductions: Obversion, Conversion, Contraposition and Inversion.

(1) **Obversion**.—In the Obverse the subject remains unchanged, while the predicate of the original proposition is replaced by its contradictory. An affirmative proposition is thus expressed in a negative form.

(*Rule of Obversion*: Negative the predicate and change the quality of the proposition.

Scheme of Obversion :—

Original Proposition :	SaP	SeP	SiP	SoP
Obverse :	Se \bar{P}	Sa \bar{P}	So \bar{P}	Si \bar{P}

(2) **Conversion**.—The inferring of one proposition from another by transposing the original terms.

Rules of Conversion : (1) No term must be distributed in the converse which was not originally distributed.

(2) The quality of the proposition must not change.

Two kinds of conversion : (i) **Simple** and (ii) **Limited** ("per accidens"). In (i) quantity remains unchanged, while in (ii) it is limited or reduced in the converse.

- A converts *per accidens*.
- E and I convert *simply*.
- O is *inconvertible*.

Scheme of Conversion :—

Original Proposition :	SaP	SeP	SiP	SoP
Converse :	PiS	PeS	PiS	(None)

(3) **Contraposition.**—It is a mode of compound immediate inference. The contraposition is the *converse of the obverse* of a given proposition.

Some logicians identify it with ‘**Conversion by negation.**’ This being the only way of converting O propositions, which cannot be converted either *simply* or *per accidens*.

Rule : First obvert, then convert.

Scheme of Contraposition :—

Original proposition :	SaP	SeP	SiP	SoP
Contrapositive :	PeS	PeS	(none)	PeS

(4) **Inversion.**—The subject of the Inverse is the contradictory of the original subject, *viz.*, \bar{S} . The Inverse is obtained by repeatedly obverting and converting, or *vice versa*. Only A and E have inverses.

Rule :— Convert either the obverted converse or the obverted contrapositive.

Scheme of Inversion—

Original proposition :	SaP	SeP	SiP	SoP
Inversion :	SoP	SiP	(None)	(None)

The converse, contrapositive and inverse can each be obverted again, and thus new inferences are possible.

Besides these *formal* eductions, there are also a number of *material* eductions, *e.g.* (1) Inference by added Determinants, (2) Inference by complex conception and (3) Inference by converse relation.

CHAPTER IV.

THE SYLLOGISM.

1. Its Nature and Definition.—Between the provinces of Judgment and Inference there is only an artificial line of demarcation, since a judgment never exists in complete isolation and independence but always belongs to a context, a system of reality. Immediate Inference borders on this artificial boundary ; hence it has been treated by some logicians under ' Relations of Propositions ' in Part II, and by others as the beginning of Part III. With the Syllogism, however, the third part of Logic unquestionably begins.

We have already distinguished between Immediate Inference, by which we draw out the implications of a Judgment, and Mediate Inference, by which we pass from one judgment to another through the medium of a third. The former starts from a *single* proposition the latter from *two*. Mediate Inference is also called Reasoning Proper, and is generally viewed as synonymous with the Syllogism, although there are some valid mediate inferences which cannot easily be reduced to the form of a syllogism.* For instance, Aristotle defines the Syllogism as a discourse or reasoning in which certain things being posited, something else than what is posited necessarily follows on

* For instance, mathematical inferences of Equality, the argument *a fortiori*, etc., are valid without being syllogistic cf. Carveth Read, *op. cit.* pp. 113—114.

their being true.* Thus the Syllogism consists of three Propositions. The third proposition, called the Conclusion,† follows from the first two, called the Premisses. If the Premisses are accepted as true, the truth of the Conclusion can never be rejected. But not *vice versa*. If the conclusion is true, the premisses are not always and necessarily true. It is not the business of Formal Logic to enquire whether the Premisses are true *in fact*. If they are, the conclusion also must be true *in fact*. Even if they are accepted as such, the conclusion cannot be rejected.

The mental process as well as the product are called Reasoning or Argumentation, and the verbal expression of the process is known as Argument.

Kant defines Syllogism as that function of thinking by which one judgment is derived from another,‡ and distinguishes it as Immediate and Mediate: the former is called the *Syllogism of the Understanding*, the latter the *Syllogism of Reason*.§ The present use of the term Syllogism is restricted to what Kant calls 'Syllogism of Reason.' Professor Wundt considers Syllogism as an expansion of the process of judgment—"eine Erweiterung des Urteilsprozesses" (*Logik*, I. 270)—

* *Prior Analytics*, I. 24. This definition is applicable to all forms of Mediate Inference.

† If the Conclusion is stated *first*, it is called the *thesis*.

‡ "Diejenige Funktion des Denken, wodurch ein Urteil aus einem andern hergeleitet wird.—Ein Schluss überhaupt ist also die Ableitung eines Urteils aus dem andern" (*Logik* 41).

§ 'Verstandesschluss' and 'Vernunftsschluss'.

and that systematic thinking through which new judgments are derived from given judgments. Professor Bosanquet defines it as the mediate reference of an ideal content to reality.

The term 'syllogism' literally means 'computation' or 'putting together.' Reasoning or Syllogism is thus the putting together of judgments, which are its elements. The simplest definition of the Syllogism is '*a combination of three Propositions so arranged that the third follows with logical necessity from the first two.*'* For instance, in the following syllogisms the conclusion is seen to follow of logical necessity from the premisses :—

1. All men are mortal,
Cæsar is a man,
∴ Cæsar is mortal.
2. X is a man,
All men are liable to err,
∴ X is liable to err.
3. Whatever smokes is fiery,
The yonder hill smokes,
∴ The yonder hill is fiery.

In the **Nyāya-Vaisheshika** system of Hindu Dialectic Inference is defined as knowledge produced from a logical datum (*parāmarsha*), which consists of the knowledge of a general principle combined with the

* *Schiller, op. cit. p. 179.* Syllogism is "the process of combining a fact and a ground of inference when no doubt is raised as to the truth of the one or the trustworthiness of the other."—A. Sidgwick.

knowledge that the case in question is one to which it is applicable.* For example, the knowledge that 'the yonder hill is characterised by invariably-fire-attended smoke' is the *parāmarsha*, from which we infer that 'the yonder hill is fiery.' The *parāmarsha* combines the two premisses together in one statement, otherwise this form of syllogism is identical with Aristotle's. This will be discussed further (*infra*).

2. Structure of the Syllogism.—The Syllogism contains three Propositions,—viz., two premisses and one conclusion—and these propositions contain three Terms, called the **Major**, the **Minor**, and the **Middle**. The Middle Term (represented as M) is common to the two premisses and therefore occurs in each. It is this mediating term which serves as a standard of comparison for the other two terms and enables us to pass from the premisses to the conclusion. The terms related through the Middle Term are called the Major and the Minor Term respectively. Each of these three terms occurs twice in the syllogism. The Minor Term is always the subject, and the Major Term the predicate in the conclusion. The Middle Term does not

* " *Vyāptivishishta-pakshadharmatā-jnāna*." This expression corresponds to Aristotle's famous *Dictum de omni et nullo* (*vide infra*), which states that what can be predicated of a class can also be predicated of anything belonging to that class. On the two Hindu systems, read the *Muktavali*, or the more elementary treatises the *Tarkasangraha* and the *Tarkakamudi*. Also read " *The Pandit*" of July 2, 1866 (Ballantyne's essay on the *Nyāya* system), Colebrooke's *Essays*, MaxMüller's *Six Systems* and Deussen's *Geschichte der Philosophie*, Vol. III.

occur in the conclusion. Of the two premisses that which contains the Major Term (P) is called the **Major Premiss**, and that which contains the Minor Term (S) is called the **Minor Premiss**. The Middle Term occurs in each of them. Thus :—

Major premiss : M—P

Minor premiss : S—M

Conclusion : S—P.

It is immaterial whether the major or the minor premiss is stated first, although it is usual to state the major first.

It is also usual to distinguish the *matter* and *form* of the syllogism. The *matter* consists of the three Propositions (*proximate matter*) and the three Terms (*remote matter*). The *form* of the syllogism consists in the necessity with which the conclusion follows from the premisses. It is the logical connexion of the premisses and the conclusion, or the mutual relation or formal validity of the three propositions. In other words, the *form* or *essence* of the syllogism consists in the necessary consequence of the conclusion from the premisses, and not in the truth of the premisses or the conclusion.

A syllogism is ‘valid’ when its conclusion follows with logical necessity from the premisses.*

* “In a valid syllogism the conclusion is always implied in the premisses—i.e., contained in the *meaning* of the two premisses when taken together. And, therefore, the conclusion and either of the premisses together determine the other premiss required.”—A. Sidgwick.

The terms of a syllogism may be viewed either in extension or in intension. For instance,

All statesmen are wise,

Pitt is a statesman,

∴ Pitt is wise.

Here the class 'wise' includes the class 'statesmen' which contains in it the individual 'Pitt.' If the terms are viewed in intension, the same syllogism may be read as follows:—

The attributes of a statesman contain the attribute, wise,

The attributes of Pitt contain the attributes of a statesman,

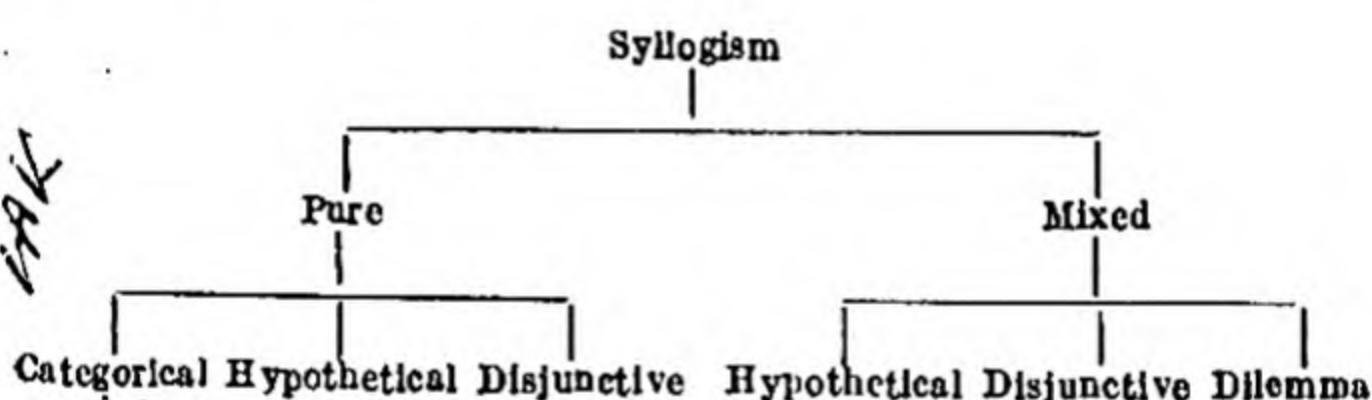
∴ The attributes of Pitt contain the attribute, wise.

It may be observed here that European logic usually employs the former mode, in which the terms refer to classes, while Hindu logic states the syllogism in abstract terms, viewing the terms in intension.

Sometimes one of the premisses is suppressed and only one premiss and the conclusion are stated. For instance, 'Pitt is wise because all statesmen are wise.' Such arguments are called Enthymemes, and their nature will be discussed in Chapter VIII.

3. Kinds of Syllogisms.—Syllogisms are classified according to the character of their premisses. We know that the classification of propositions, most important for logical purposes, is that according to *relation*. That is also the basis of the classification of

Syllogisms. If the two premisses of a syllogism are (i) both Categorical, or (ii) both Hypothetical, or (iii) both Disjunctive, we have a **Pure Syllogism**. In (i) it is Pure Categorical, in (ii) Pure Hypothetical, and in (iii) Pure Disjunctive, Syllogism. We have, however, a **Mixed Syllogism**, (i) when the major premiss is hypothetical, the minor, categorical—called the *Mixed Hypothetical Syllogism*, (ii) when the major premiss is disjunctive, the minor, categorical—called the *Mixed Disjunctive Syllogism*, and (iii) when the major premiss is hypothetical, the minor, disjunctive—called the *Dilemma*. Thus :—



The axioms and rules of the Pure Categorical Syllogism, which we are going to discuss, apply equally to Pure Hypothetical and Pure Disjunctive Syllogisms. Mixed syllogisms will be taken up separately in Chapter IX below.

4. Axioms of the Syllogism.—The syllogism, like all other formal reasoning, is based ultimately on the Laws of Thought. In it two terms (S and P) are compared with a middle term (M) in order to discover whether they agree or disagree with each other. The Laws of thought make no explicit reference to the middle term, hence the rules of the syllogism cannot be derived

from them directly but only through other principles called the *mediate axioms of the syllogism*. These axioms are only the more developed forms of the primary laws of thought, and are applicable to all possible forms of the syllogism. They may be stated as follows :

- (1) If two terms agree with one and the same third, they agree with each other.
- (2) If one term agrees and another disagrees with one and the same third, these two disagree with each other.

This is Whately's* statement of the axioms and its analogy with Euclid's axioms is remarkable. Other logicians † such as Hamilton and Thomson, have stated these general principles differently, combining them into one axiom.

5. “**Dictum De Omni et Nullo**”.—Aristotle and the scholastic logicians regarded that form of the syllogism as the perfect type in which the major premiss states a universal principle and the minor premiss applies the principle to a particular case—in other words, this type contains the middle term as *subject* in the major premiss, and *predicate* in the minor premiss. It may be symbolically represented thus :—

$$\begin{array}{c} M-P \\ S-M \\ \therefore \underline{S-P} \end{array}$$

All the other forms of syllogism can be ‘reduced’ to this type by means of *eduction*. The *Dictum*

* Whately, *Elements of Logic*, 5th ed. p. 83.

† *Vide* Welton, *Logic*, I, p. 284.

is the axiom that applies to this form alone and the validity of all other forms of syllogism is tested by first 'reducing' them to this type and then applying the *Dictum*. This axiom of Aristotle is known as the "Dictum de omni et nullo." It is really a double axiom : (i) *Dictum de omni* and (ii) *Dictum de nullo*, and may be enunciated as follows :—

"Whatever is predicated, whether affirmatively or negatively, of any class may be predicated in like manner of anything belonging to that class."

or

"Whatever is affirmed (or denied) universally of any logical whole may, in like manner, be affirmed (or denied) of any logical part of that whole."

The *Dictum* is directly applicable to the perfect form of the syllogism, and indirectly to other forms on their reduction to the standard form. Its application helps us to draw from the premisses correct conclusion both as to quantity and quality. The *Dictum* does not imply that the terms about which affirmation or denial is made are to be reckoned in extension. If it does, it reduces the syllogism to mere tautology, since the subject taken as a collection of individuals leaves no room for a further predication of each individual. Hence the subject is the *logical whole*, which is not a mere collection of individuals, but includes even those which are unknown to us. We reason from a logical whole to one of its parts. On the purely

class-inclusion view, the *Dictum* seems to be of very little use.*

The *Dictum* cannot be disposed of as a mere "figure-head."† Although it is analytic in so far as it states no more than is covered by the definitions of 'syllogism' and 'Middle term,' yet it also tells us that we are justified in our inference if certain conditions are fulfilled. Such conditions are the general rules or canons of the syllogism, which can be easily derived from the *Dictum* itself.‡ The *Dictum*, when analysed, gives the following requirements of the valid syllogism :—(a) three propositions, (b) three terms, (c) middle term to be distributed, (d) one premiss to be affirmative, (e) A negative premiss makes the conclusion negative. These are the general rules of syllogistic reasoning, to which are also added some special rules, such as, 'if a term is not distributed in the premisses, it must not be distributed in the conclusion,' which cannot be directly derived from the *Dictum*. We now proceed to enunciate the rules of the syllogism.

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* That it only applied to reasoning in extension was supposed to be its defect. In order to remove it another dictum, called the *Nota notæ*, was proposed for reasoning in intension. cf. *Welton* p. 286.

† That is how Mr. Boyce Gibson takes it (*op. cit* p. 243). We, however, think that there is justification for treating the *Dictum* as an *axiom* or a *principle*, and not a mere figure-head. On this point cf. *Carveth Read*, *op. cit.* p. 111.

‡ Cf. *Welton*, *op. cit.* p. 287, *Croke*, *Logic*, p. 131, *Carveth Read*, *op. cit.* p. 111.

the rules of quantity and quality taken together. Even these rules are not quite independent of each other ; for, Rule V is deducible from Rule III ; and also the first part of Rule VI may be deduced from Rule V, and *vice versa*.

The general syllogistic rules are summed up in the following mnemonic verses,* which are traditional in English works on Logic :—

Distribuas medium, nec quartus terminus adsit ;
 Utraque nec praemissa negans, nec particularis ;
 Sectetur partem conclusio deteriorem ;
 Et non distribuat, nisi cum praemissa, negetve.

The meaning is : you must distribute the middle term, and not have a fourth ; both premisses must not be negative, nor both particular ; the conclusion must follow the weaker part of the premisses,† and must not distribute a term, nor deny, unless one premiss does the same.

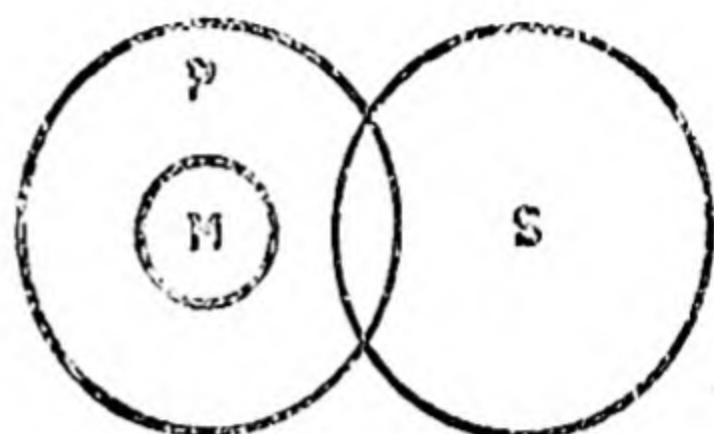
7. **Typical Exercises worked out.**—We shall now work out a few exercises on the application of the syllogistic rules in order to familiarise the student with the process of detecting invalid syllogisms and of discovering, when a conclusion and a premiss are given,

* Cf. Joyce, *op. cit.* p. 173n., Joseph, *op. cit.* p. 254. Coffey, *op. cit.* p. 317. These lines are attributed to Petrus Hispanus, afterwards Pope John XXI.

† i.e., the conclusion must be *negative*, if one premiss is negative, and it must be *particular*, if one premiss is particular. The negative and the particular are inferior in quality and quantity to the affirmative and the universal respectively.

the other premiss which will go to make the conclusion valid.

$$\begin{array}{c}
 (1) \text{ All } M \text{ is } P \\
 \text{No } S \text{ is } M \\
 \hline
 \therefore \text{No } S \text{ is } P
 \end{array}$$



Here the major term P is distributed in the conclusion, but is undistributed in the premiss, hence the syllogism is invalid, and is an example of the fallacy of the *Illicit Process of the Major*.

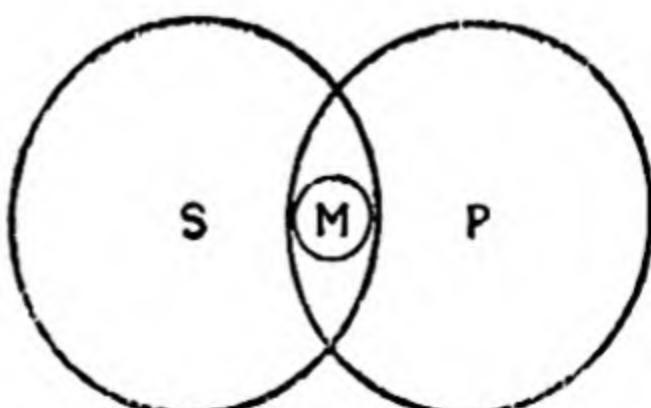
$$\begin{array}{c}
 (2) \text{ All dogs have tails} \\
 \text{No cats are dogs} \\
 \hline
 \therefore \text{No cats have tails}
 \end{array}$$

This is another example of the fallacy of *Illicit Process of the Major*.

$$\begin{array}{c}
 (3) \text{ All } P \text{ is } M \\
 \text{All } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is } P
 \end{array}
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Here } M \text{ is undistributed,} \\
 \text{hence the argument is} \\
 \text{invalid. (Rule III.)}$$

$$\begin{array}{c}
 (4) \text{ No } M \text{ is } P \\
 \text{All } M \text{ is } S \\
 \hline
 \therefore \text{Some } S \text{ is not } P
 \end{array}
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{This syllogism breaks no rule} \\
 \text{and is therefore valid.}$$

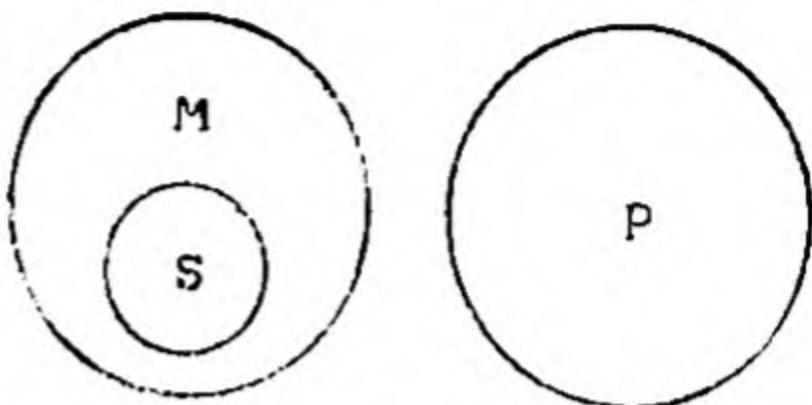
$$\begin{array}{c}
 (5) \text{ All } M \text{ is } P \\
 \text{All } M \text{ is } S \\
 \hline
 \therefore \text{All } S \text{ is } P
 \end{array}$$



This illustrates the *Illicit Process of the Minor*. The minor term S is distributed in the conclusion, but is not distributed in the minor premiss.

(6) No M is P
 All S is M

$$\therefore \text{No S is P}$$



This syllogism breaks no rule, and is therefore valid.

(7) No P is M Some P is M No P is M All P is M
 All M is S All M is S Some S is M No M is S

$$\therefore \text{No S is P} \therefore \text{Some S is P} \therefore \text{No S is P} \therefore \text{No S is P}$$

All these syllogisms are valid. The student may test their validity by means of Euler's Circles.

(8) All M is P { No conclusion is possible
 No M is S { by Rule IX.

(9) Some P is M { No conclusion by Rule VII,
 Some S is not M { both premisses are parti-
 cular.

(10) All P is M { No conclusion by Rule III,
 Some M is S { M is not distributed in
 either of the premisses.

(11) { No P is M { No conclusion by Rule V,
 { Some S is not M { Both premisses are nega-
 tive.

(12) No P is M { Illicit process of the minor.
 Some M is S { The valid conclusion

$$\therefore \text{No S is P}$$
 { would be 'Some S is not P.'

(13) Construct the syllogism with 'Some P is M' as the major premiss and 'Some S is P' as the conclusion.

Here M is given as undistributed in the major premiss, and, therefore, it must be distributed in the minor premiss (Rule III). The minor term S is undistributed in the conclusion, and therefore cannot be distributed in its premiss (Rule IV). As the conclusion is affirmative, both premisses must be affirmative. Hence the minor premiss must be 'all M is S.'

(14) 'All S is P,' because 'Some P is not M.'

Here the given premiss is negative, while the conclusion is affirmative. This is impossible by Rule VI. Thus no syllogism can be constructed with these data.

(15) 'Some S is not P,' because 'Some S is not M.'

Here a conclusion and the minor premiss are given, and we have to find out the major premiss. Now, the middle term M is distributed in the given premiss, and therefore need not be distributed in the missing premiss (Rule III). Again, P is distributed in the conclusion, and therefore must be distributed in the major premiss (Rule IV). As the given premiss is negative, the missing one must be affirmative (Rule V). Therefore the required major premiss must be 'All P is M.' Thus we construct the syllogism :—

All P is M
Some S is not M
 ∴ Some S is not P

(16) All P is M

* * *

∴ All S is P

Here the minor premiss is missing. M is undistributed in the major premiss, and therefore must be distributed in the minor (Rule III). S is distributed in the conclusion, and therefore must also be distributed in the minor premiss (Rule IV). As the conclusion is affirmative, the missing premiss must also be affirmative. (Rule VI). But an affirmative proposition cannot distribute both its terms, but unless both S and P are distributed the conditions cannot be fulfilled. Hence no syllogism can be constructed to satisfy these conditions.

(17) All P is M

* * *

∴ No S is P

Here we have to discover the minor premiss. M is not distributed in the given major, and therefore must be distributed in the missing minor (Rule III). S is distributed in the conclusion, and therefore must be distributed in its premiss (Rule IV). As the conclusion is negative, and the given premiss is affirmative, the missing premiss must be negative (Rule VI). Thus we get the minor premiss, 'No M is S' or 'No S is M.' It distributes M as well as S and is negative.

(18) * * *

All S is M

∴ No S is P

Here the major premiss is missing. The conclusion is negative and the given premiss is affirmative, therefore the missing premiss must be negative (Rule VI). M is undistributed in the given premiss, therefore it

must be distributed in the major (Rule III). P is distributed in the conclusion, and therefore must be distributed in the missing major premiss (Rule IV). Thus in the required premiss both terms must be distributed. Therefore either 'No M is P' or 'No P is M' will serve the purpose, and the syllogism will be framed as follows :—

$$\begin{array}{c}
 \text{No M is P} \\
 \text{All S is M} \\
 \hline
 \therefore \text{No S is P}
 \end{array}
 \qquad
 \begin{array}{c}
 \text{No P is M} \\
 \text{All S is M} \\
 \hline
 \therefore \text{No S is P}
 \end{array}$$

3. Application of Syllogistic Rules to Pure Hypothetical and Pure Disjunctive Syllogism.—All the rules applicable to the Pure Categorical Syllogism apply, *mutatis mutandis*, to Pure Hypothetical Syllogisms, since the distinctions of quantity and quality apply equally to categorical as well as hypothetical propositions. The 'terms' of a Pure Hypothetical Syllogism are 'clauses' or 'propositions.' The consequent of the conclusion is the 'major' term ; the antecedent of the conclusion corresponds to the 'minor' term ; and the 'middle' term is the element which is to be found in the premisses only. As to distribution of terms, it may be noted that 'always' corresponds to 'all' of categoricals, 'never' to 'no,' 'sometimes' to 'some,' and 'sometimes not' to 'some not,' and thus the quantity of the antecedent is determined. The consequent of a negative Hypothetical is distributed, while in the case of an affirmative Hypothetical it is not distributed.

With regard to Pure Disjunctive Syllogism, it may be pointed out that Rules V and VI do not apply to them, since all disjunctive propositions are affirmative.*

SUMMARY.

A judgment never leads a completely isolated and independent life. It has its place in a system of thought. It is woven and interwoven with other judgments. The process of passing from one judgment to another through the medium of a third is called **Mediate Inference** or **Reasoning Proper**. Its most typical form is the **Syllogism**.

Aristotle defines the **Syllogism** as a discourse or reasoning in which certain things being posited, something else than what is posited necessarily follows on their being true.

Syllogism is a combination of three propositions so arranged that the third follows with logical necessity from the first two. If the first two propositions are accepted as true, the truth of the conclusion follows of necessity. The first two propositions are called the **Premisses**, and the third proposition, the **Conclusion**.

A syllogism contains three terms. The **Major Term** (P) is the predicate in the conclusion, while the **Minor Term** (S) is the subject. The **Middle Term** does not occur in the conclusion, but by occurring in each of the

* See Welton, *op. cit.* i. pp. 304—5 and 348—51.

two premisses 'mediates' between the other two terms (known as the 'extremes') and indicates the common link which binds them together, and makes their comparison possible. The **Major Premiss** contains the major and the middle terms, while the **Minor Premiss** contains the minor and the middle.

The **matter** of the syllogism consists in its three propositions ('*proximate matter*') and its three terms ('*remote matter*'). Its **form** consists in the necessity with which the conclusion follows from the premisses.

The terms of a syllogism may be viewed either in extension or in intension. The former view is not always correct, while the latter is more exact and consistent. Western Logic usually follows the former, while Hindu Dialectic always follows the latter view.

Syllogisms	... {	(i) Pure	... { (a) Categorical.
			... { (b) Hypothetical.
	... {	(ii) Mixed	... { (c) Disjunctive.
			... { (a) Hypothetical.
			... { (b) Disjunctive.
			... { (c) Dilemma.

Mediate Axioms of the Syllogism are only the more developed forms of the Primary Laws of Thought.

Aristotle regarded the following type as the most *perfect* form of the syllogism :—

$$\begin{array}{c}
 M-P \\
 S-M \\
 \hline
 \therefore S-P
 \end{array}$$

All the other forms could be reduced to this type. The **Dictum de omni et nullo** is the axiom which he applied to this form. The *Dictum* may be stated thus :

“Whatever is affirmed (or denied) universally to any logical whole, may, in like manner, be affirmed (or denied) of any logical part of that whole.”

The General Rules of the Syllogism are deducible from this *Dictum*.

They are as follows :—

A. Structural Rules :—

- I.—A syllogism must contain *three* terms only.
- II.—A syllogism must contain *three* propositions only.

B. Rules of Quantity :—

- III.—The Middle term must be distributed at least once.
- IV.—No term must be distributed in the conclusion which was not distributed in the premisses.

C. Rules of Quality :—

- V.—Two negative premisses prove nothing.
- VI.—If either premiss is negative, the conclusion must be negative ; and to prove a negative conclusion one of the premisses must be negative.

D. *Corollaries* :—

VII.—Two particular premisses prove nothing.

VIII.—If one premiss is particular, the conclusion must be particular.

IX.—If one premiss is negative and the major term is undistributed in its premiss, there is no conclusion.

The first two rules are implied in the very structure or definition of a syllogism. The last three are corollaries, which can be deduced from the fundamental rules (III, IV, V and VI) taken together.

By the application of these 'rules' or 'canons' one can discriminate between *valid* and *invalid* syllogisms.



CHAPTER V.

FIGURES AND MOODS OF THE SYLLOGISM.

1. **Distinctions of Figure and Mood.**—We have stated the General Syllogistic Rules by the application of which we may be able to discriminate valid and invalid syllogisms. Now valid syllogisms may differ from one another (*i*) in Figure, and (*ii*) in Mood. Differences of Figure depend on the position of the middle term* in the premisses, while differences of Mood are generated by differences in the kinds of propositions used. We may, therefore, define Figure as the form of a syllogism determined by the position of the middle term in the premisses, and Mood as the form of a syllogism determined by the quantity and quality of its constituent propositions.

There are four possible figures:—

- (i) If the middle term is the subject in the major premiss and the predicate in the minor (First Figure).
- (ii) If the middle term is the predicate in both premisses (Second Figure).
- (iii) If the middle term is the subject in both premisses (Third Figure).
- (iv) If the middle term is the predicate in the major and the subject in the minor premiss (Fourth Figure).

* The position of S and P is fixed in the conclusion by definition. And as M occurs in both premisses, the position of S and P is determined by that of the middle term. Hence in determining the figures of the syllogism we consider the position of the middle term only.

The following forms represent the four figures:—

Fig. 1

Fig. 2

Fig. 3

Fig. 4

M—P

P—M

M—P

P—M

S—M

S—M

M—S

M—S

∴ S—P

∴ S—P

∴ S—P

∴ S—P

Now as to differences of Mood, we may observe that they may be the same in different figures or different in the same figure.

1	MaP	MeP	PeM	MaP	MeP	PaM
2	SaM	SaM	SaM	MaS	MaS	MaS
3	∴ SaP	∴ SeP	∴ SeP	∴ SiP	∴ SoP	∴ SiP

These six forms represent respectively the moods AAA and EAE in Fig. 1, EAE in Fig. 2, AAI and EAO in Fig. 3, and AAI in Fig. 4.

There are sixty-four possible moods. For there are four propositions A, E, I and O; and three at a time constitute a syllogism. Thus we have to find out the permutations of four things taken three at a time: thus $4^3 = 64$. This can be proved in another way. The major premiss may be A or E or I or O. In each case we can have four different minor premisses, A or E or I or O. Thus we have sixteen combinations. But each of these may have in its conclusion A or E or I or O, which gives us sixty-four conceivable moods. Thus:—

There are 4 possible figures.

There are 64 possible moods.

Hence, there are 256 possible forms of syllogism.

2. Discovery of the Valid Moods.—Of the sixty-four conceivable moods, only eleven are found to be valid irrespective of considerations of figure. This discovery is made in the following way: We first put down all the sixty-four possible moods, *viz.*—

AAA	EAA	IAA	OAA
AAE	EAЕ	IAE	OAE
AAI	EAИ	IAI	OAI
AAO	EAО	IAO	OAO
AEA	EEA	IEA	OEA
SEE	EEE	IEE	OEE
AEI	EEI	IEI	OEI
AE0	EE0	IE0	OEO
IAIA	EIA	IIA	OIA
IAE	EIE	IEE	OIE
AI	EII	III	OII
AI0	EIO	II0	OIO
AOA	EOA	IOA	OOA
AOE	EOE	IOE	OOE
AOI	EOI	IOI	OOI
AO0	EO0	IO0	OO0

If we apply the General Rules of Syllogism to these, we shall be able to eliminate all those which violate any of these rules. Some of them will have two negative premisses, others two particular premisses; while some, again, will have a negative conclusion with two affirmative premisses, or affirmative conclusion from a negative premiss or a universal conclusion from a particular premiss, and in one case, *viz.*, in IEO we have the Illicit

Process of the Major. Thus without reference to varieties of figure and simply by the application of the General Syllogistic Rules we arrive at the following eleven moods, which cannot be rejected and which are, therefore, legitimate:—

AAA, AAI, AEE, AEO, AII, AOO ; }
EAE, EAO, EIO ; IAI ; OAO. } moods

In order to find out how many of these moods are valid in each of the four figures we must know the Special Rules of each Figure, which are stated in the next section.

3. Special Rules of the Four Figures.—Each of the four figures has its special rules. These can be deduced from the general syllogistic rules with special reference to the form of the figure.

FIGURE I.

RULE 1.—*The minor premiss must be affirmative.*

M—P Proof: Suppose the minor premiss is negative.

$$\begin{array}{r} S-M \\ \hline \therefore S-P \end{array}$$

 Then the major must be affirmative (Rule V), and the conclusion must be negative (Rule VI); that is, the major term will be distributed in the conclusion but undistributed in the premiss. Thus we have the fallacy of Illicit Major (Rule IV). Hence in Fig. 1 the major premiss cannot be negative, and must therefore be affirmative.

RULE 2.—*The major premiss must be universal.*

Proof: As the minor premiss is affirmative, the middle term is there undistributed, and must therefore be distributed in the major premiss (Rule III). But it is the subject in that premiss, therefore the major premiss must be universal.

FIGURE 2.

RULE 1.—*One premiss must be negative.*

P—M Proof: If both premisses are affirmative,

$$\begin{array}{r} \text{S—M} \\ \hline \therefore \text{S—P} \end{array}$$
 there would be an undistributed middle (Rule III). Hence the conclusion must always be negative (Rule VI).

RULE 2.—*The major premiss must be universal.*

Proof: Otherwise there would be an Illicit Major (Rule IV).

FIGURE 3.

RULE 1.—*The minor premiss must be affirmative.*

M—P Proof: Otherwise there would be an Illicit Major

$$\begin{array}{r} \text{M—S} \\ \hline \therefore \text{S—P} \end{array}$$
 Major (Rule IV).

RULE 2.—*The conclusion must be particular.*

Proof: Otherwise there would be an Illicit Minor (Rule IV).

FIGURE 4.

RULE 1.—*If the major premiss is affirmative, the minor must be universal.*

P—M Proof: If the minor were particular, we would have an Undistributed Middle (Rule III).

$$\begin{array}{l} \text{P—M} \\ \text{M—S} \\ \therefore \text{S—P} \end{array} \qquad \begin{array}{l} \text{would have an Undistributed} \\ \text{Middle (Rule III).} \end{array}$$

RULE 2.—*If the minor premiss is affirmative, the conclusion must be particular.*

Proof: Otherwise there will be an Illicit Minor.

RULE 3.—*If either premiss is negative, the major premiss must be universal.*

Proof: Otherwise there will be an Illicit Major.

The rules of Fig. 4 are hypothetical, since the quality of either premiss cannot be absolutely determined.

4. Determination of Valid Moods in each Figure.
 —Now we are in a position to apply the Special Rules of each figure in order to find out what moods are valid in each of the four figures.* Of the eleven valid moods, *viz.*, AAA, AAI, AEE, AEO, AII, AOO, EAE, EAO, EIO, IAI and OAO, we have to determine how many are valid in each figure.

Figure 1:—

Rule 1 of this figure eliminates three moods, *viz.*, AEE, AEO, AOO. Of the remaining eight, Rule 2

* We can also determine them in other ways, by reference to the Primary Laws of Thought or to the General Syllogistic Rules. See Welton, *op. cit.* i. pp. 315—322.

further eliminates two, *viz.*, IAI and OAO. Thus we are left with the following six moods which are valid in the First Figure :—

AAA, AAI, AII, EAE, EAO, EIO.

A still further reduction is possible, since AAI and EAO are included respectively in AAA and EAE. The moods AAI and EAO are therefore superfluous. Hence the valid moods in the First Figure are the following four :—

AAA, AII, EAE, EIO.

Figure 2 :—

Rule 1 of this figure invalidates AAA, AAI, AII, IAI. Rule 2 rejects OAO. Hence the remaining six moods valid in this figure are :—

AEE, AEO, AOO, EAE, EAO, EIO.

Of these, AEO and EAO are superfluous, being included in AEE and EAE respectively. Thus we are left with the following four moods which are valid in the Second Figure :—

AEE, AOO, EAE, EIO.

Figure 3 :—

Rule 1 of this Figure eliminates AEE, AEO, AOO (as in Fig. 1), while Rule 2 further invalidates AAA, EAE. The remaining six valid moods are :—

AAI, AII, EAO, EIO, IAI, OAO.

None of these is superfluous. Hence in the Third Figure there are six valid moods.

Figure 4 :—

Rule 1 rejects AII, AOO; Rule 2 rejects AAA EAE; and Rule 3 invalidates OAO. The remaining six moods are :—

AAI, AEE, AEO, EAO, EIO, IAI.

Of these, the mood AEO is superfluous, since it is included in AEE. Hence there are five valid moods in the Fourth Figure, *viz.* :—

AAI, AEE, EAO, EIO, IAI.

Thus we discover that there are altogether nineteen valid moods of the syllogism in all the four figures taken together—four in the first figure, four in the second six in the third and five in the fourth figure. These nineteen, however, exclude the five valid moods, which we have omitted as superfluous. The moods thus omitted—*viz.*, AAI and EAO in Fig. 1, AEO and EAO in Fig. 2, and AEO in Fig. 4—are called **Subaltern Moods**, since their conclusions are the subalterns of the corresponding universals, which are justified by their premisses. They are also called **Weakened Syllogisms** or **Syllogisms with weakened conclusions**. If these five subaltern moods are included in the number of valid moods, we have altogether twenty-four. We see that in the third figure there are no subaltern moods, since no universal conclusion can be inferred in this figure.

Of the nineteen valid moods, fifteen are called **Fundamental**, since neither of their premisses is stronger

than is necessary to produce the conclusion. In some of them, however, (for instance in AAI and EAO in Fig. 3 and 4), the same conclusion can be obtained, if for one of the premisses its subaltern is substituted. Such syllogisms as have one of their premisses unnecessarily strong for the conclusion are known as **Strengthened Syllogisms**. All valid moods with two universal premisses and a particular conclusion—with the exception of AEO in Fig. 4—are *strengthened syllogisms*.

On comparing the conclusions arrived at in each of the nineteen valid moods, it appears that :—

A can be proved in only one mood, and in the First Figure only.

E can be proved in four moods, and in every Figure except the Third.

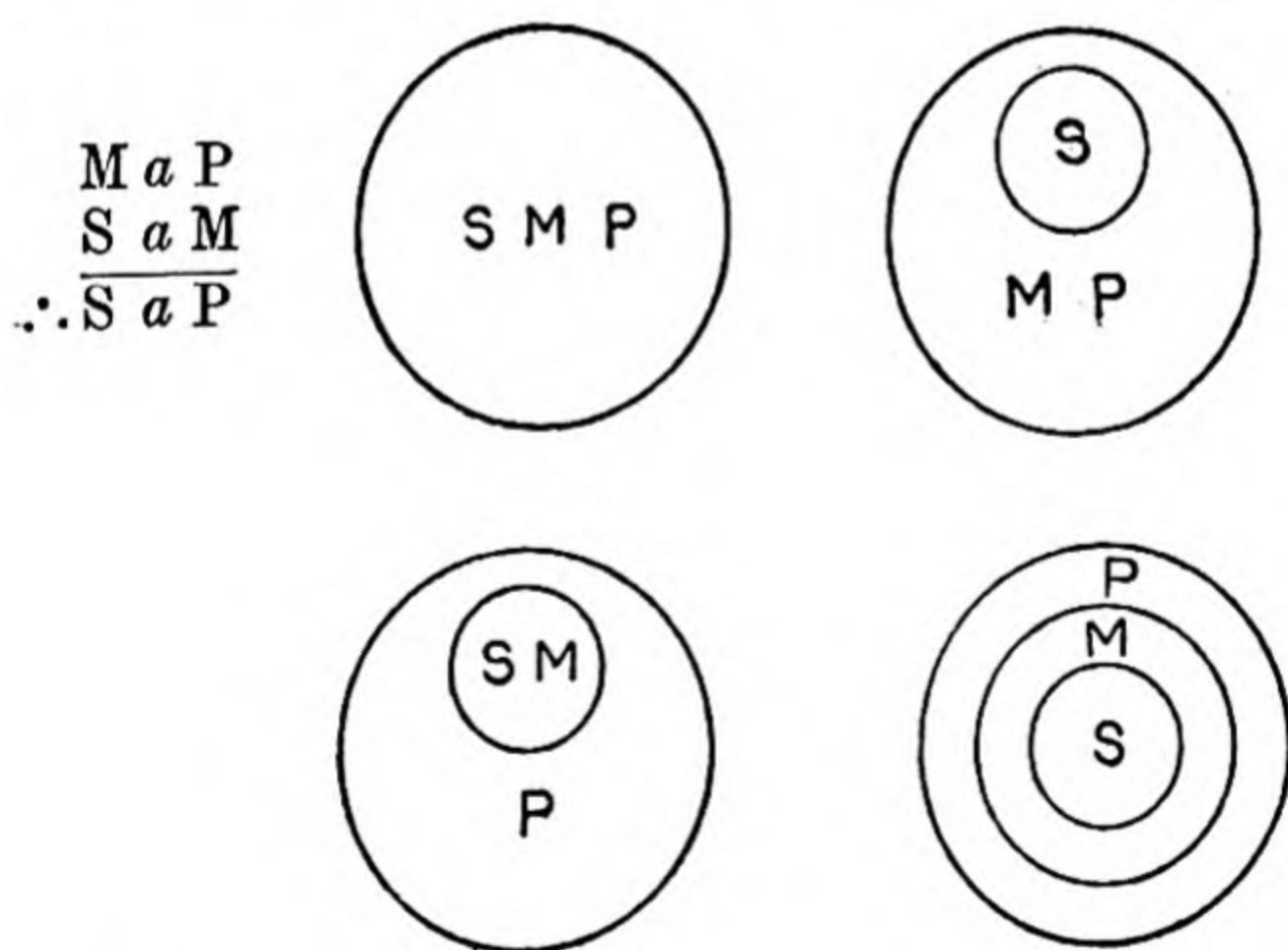
I can be proved in six moods, and in every Figure except the Second.

O can be proved in eight moods, and in all Figures.

The universal affirmative A is seen to be proved only in *one* mood (*viz.*, AAA in Fig. 1), because it is the most difficult proposition to establish but when once established it has the highest scientific value. The particular negative O is proved in no less than eight moods, simply because it is the easiest to prove (while its contradictory A is the easiest to disprove, if once established) and has the least scientific value. Of this, however, we shall speak presently (cf. Sec. 6 *infra*).

The student should also be able to represent syllogisms by means of circles (Euler's method) or lines (Lambert's method). Although such symbolic representations are sometimes misleading, their practical value cannot be denied. Circles are the neatest of figures and are most commonly used for this purpose. Now, as the conclusion in any mood must be in the form of A or E or I or O, we give below the diagrammatic representation of the four moods in the First Figure. It will be shown later on (in the following chapter) that the moods in the remaining three figures can be reduced to those in the first. Hence the moods in the First Figure represent the abstract types of every possible valid argument.

Conclusion A : *Barbara* :—

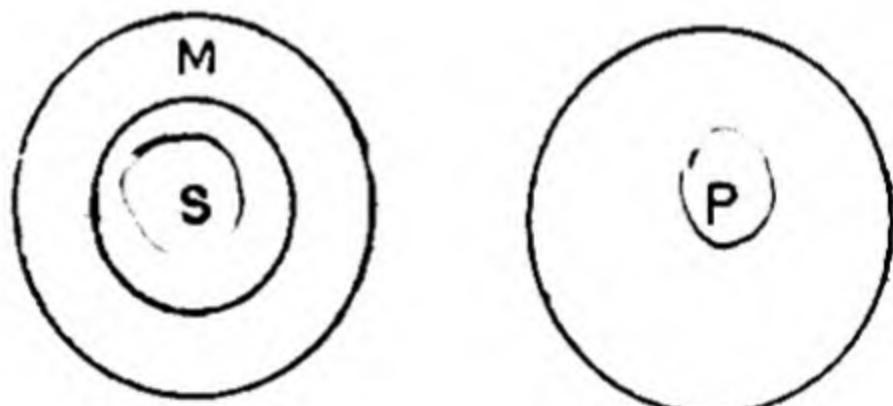


The last of these is most commonly used for this mood. The first shows the coincidence of the three

circles—representing the extensions of S, M and P respectively ; in the second M and P coincide ; in the third S and M coincide ; while in the fourth there is no coincidence or overlapping of any circle. In the following diagrams of other moods we take the most common form ; the student can easily draw the corresponding diagrams in which some circles are coincident.

Conclusion E : *Celarent* :—

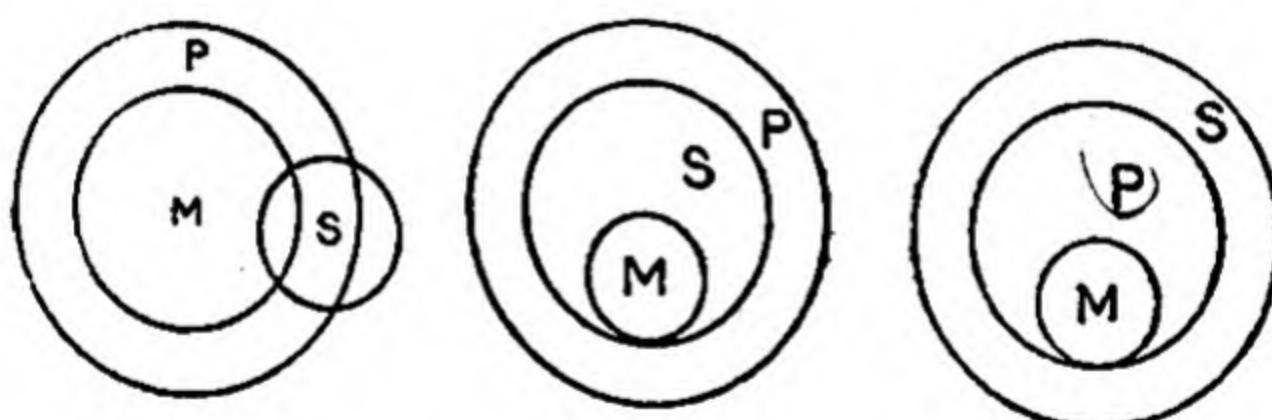
$$\begin{array}{l} M e P \\ S a M \\ \hline \therefore S e P \end{array}$$

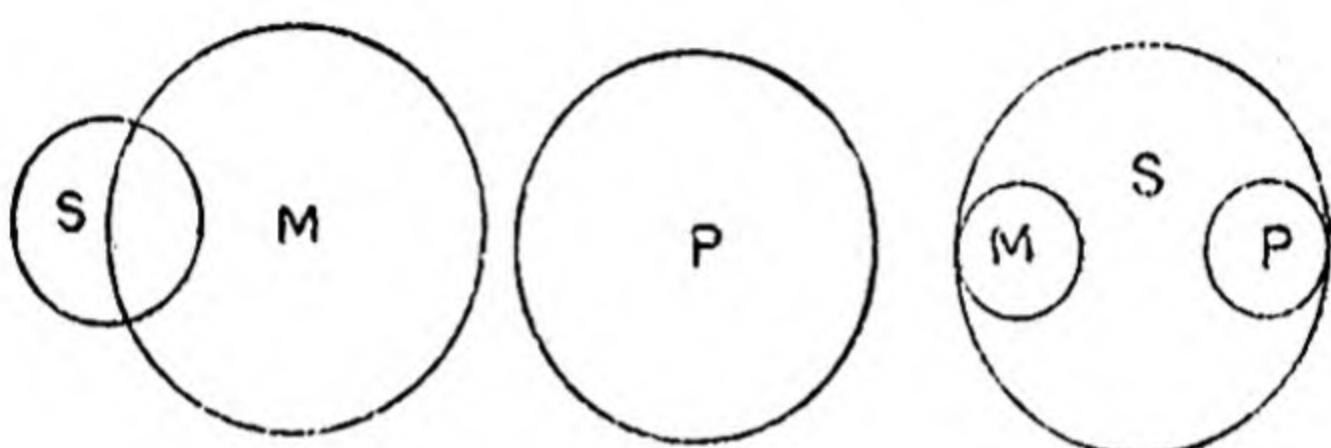
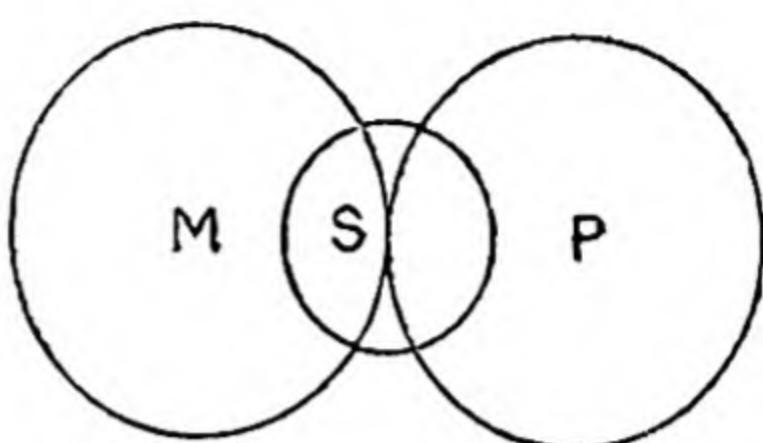


Conclusion I : *Darii* :—

$$\begin{array}{l} M a P \\ S i M \\ \hline \therefore S i P \end{array}$$

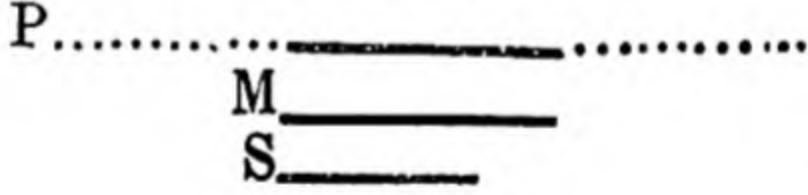
Find 3

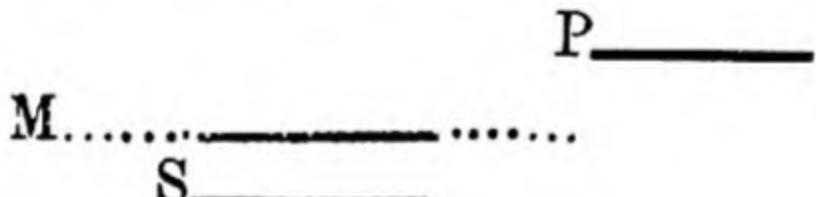


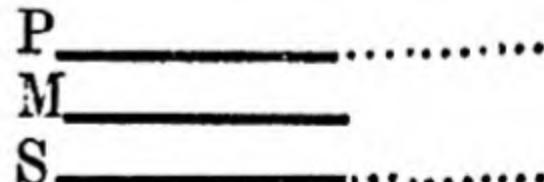
Conclusion O : *Ferio* :—
$$\begin{array}{l} M \epsilon P \\ S \cap M \\ \therefore S \cap P \end{array}$$


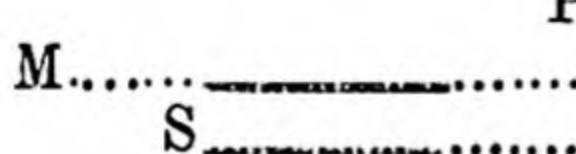
It will be interesting to the student if he tries to represent each of the valid moods by means of Euler's circles.

In Lambert's notation* we have —

Barbara : 

Celarent : 

Darii : 

Ferio : 

* For other schemes see Welton i. pp. 220 ff. and 346 ff.

5. The Mnemonic Lines.—The nineteen valid moods we have established have been tabulated in the following famous mnemonic verses of the Traditional Logic :—

*Barbara, Celarent, Darii, Ferioque prioris ;
Cesare, Camestres, Festino, Baroco secundae ;
Tertia Darapti, Disamis, Datisi, Felapton,
Bocardo, Ferison, habet ; Quarta insuper addit
Bramantip, Camenes, Dimaris, Fesapo, Fresison.**

These mnemonics assign a particular name to each valid mood of each of the four figures, thus :—

Fig. 1 : *Barbara, Celarent, Darii, Ferio.*

Fig. 2 : *Cesare, Camestres, Festino, Baroco.*

Fig. 3 : *Darapti, Disamis, Datisi, Felapton,
Bocardo, Ferison.*

Fig. 4 : *Bramantip, Camenes, Dimaris,
Fesapo, Fresison.*

* An earlier form of these mnemonics, which contained the indirect moods of the first figure instead of the moods of the fourth figure, is traced back to the works of William Shyreswood and Petrus Hispanus (afterwards Pope John XXI), schoolmen of the 13th century. To the lines given above are sometimes added the following two, which dispose of the *subaltern moods* :—

Quinque subalterni, totidem generalibus orti,

Nomen habent nullum, nec, si bene colligis, usum.

i.e., 'The five subaltern moods, which are derived from the same number of moods with universal conclusions, have no name and, if you draw the conclusion rightly, no use.' Logicians have, however, called these five words by the names *Barbari, Celaront, Cesaro, Camestrop* and *Camenop* after the universal moods in which they are contained.

Each mood contains three vowels, which tell us of the three propositions, which form that mood. For instance, Barbara contains AAA, Disamis IAI, Camenes AEE, etc., in the major premiss, minor premiss and conclusion respectively. The significance of the consonants will be explained in the next chapter under Reduction of Syllogisms.

The Special Rules of the four figures can also be derived from the mnemonic lines. For instance, let us put down the valid moods of the first figure in the following vertical columns and see if the rules are self-evident :—

FIGURE 1.

<i>b</i>	<i>A</i>	<i>r</i>	<i>c</i>	<i>E</i>	<i>l</i>	<i>d</i>	<i>A</i>	<i>f</i>	<i>E</i>		—Major premisses are universal.
<i>b</i>	<i>A</i>	<i>r</i>		<i>A</i>		<i>r</i>	<i>I</i>	<i>r</i>	<i>I</i>		—Minor premisses are affirmative.
	<i>A</i>		<i>r</i>	<i>E</i>	<i>nt</i>		<i>I</i>		<i>O</i>		

FIGURE 3.

<i>A</i>	<i>I</i>	<i>A</i>	<i>E</i>	<i>O</i>	<i>E</i>						
<i>A</i>	<i>A</i>	<i>I</i>	<i>A</i>	<i>A</i>	<i>I</i>						—All minor premisses are affirmative.
<i>I</i>	<i>I</i>	<i>I</i>	<i>O</i>	<i>O</i>	<i>O</i>						— All conclusions are particular.

The student can similarly demonstrate the rules of the remaining two figures.* Syllogistic problems can thus be solved in three ways :—(1) by the General

* See, for instance, Stock, *op. cit.* p. 285.

Syllogistic Rules, (2) by the Special rules of the four Figures, and (3) by the mnemonic lines. The student will find it useful to make use of Euler's circles to express syllogisms, and will thereby be able to discover their validity or invalidity at a mere glance.

6. Characteristics and Uses of the Four Figures.—Each of the four figures has its own specific characteristics and uses, which may be stated as follows:—

Figure 1.—A glance at the mnemonic lines will show that it is the only figure in which conclusions of all the four forms A, E, I, O can be proved. None of the other figures yields an A conclusion. This fact is enough to show that it is the most important and useful of all the syllogistic figures, especially in deductive science, which aims at drawing universal affirmative conclusions. For that reason, it is also called the Scientific Figure. Further, we notice that this is the only figure in which the subject of the conclusion is the subject in the minor premiss, and the predicate of the conclusion is the predicate of the major premiss—the most natural arrangement. This natural order is not observed in any other figure. These considerations point to the superiority of the first figure over the others. It has, therefore, rightly been called the Perfect Figure.

Figure 2.—In this figure we can prove only negative conclusions, hence its scope of usefulness is greatly limited. It has been called the *exclusive* figure, because

it is employed in the process (called *abscissio infiniti*) in which we go on excluding, one by one, various suppositions as to the real nature of that which is under investigation. It is essentially the figure of denial and is of particular use in the Disjunctive Syllogism.

Figure 3.—This figure proves particulars only, and can advantageously be used if we seek to establish *exceptions* to a universal proposition asserted by our opponent. It is also suitable in dealing with singular propositions, since in it alone can a singular term stand as subject in both premisses.

Figure 4.—This figure was not recognised by Aristotle and is said to have been added later on by Galen (a Roman physician of the second century), and is thus known as the *Galenian* figure. It is not usually noticed in older works on logic, and even some of the modern logicians reject it as an unnatural form, although in order to complete the formal theory of the syllogism they are compelled to recognise its valid moods as ‘indirect moods of Figure 1.’* Its importance is

* The following is the earliest form of the mnemonic lines. In it the moods of Fig. 4 are enumerated as ‘the indirect moods of fig. 1,’ viz., Baralip, Celantes, Dabitis, Fapesmo and Frisesom :

Barbara, Celarent, Darii, Ferio, Baralip**ton**,
Celantes, Dabitis, Fapesmo, Frisesom**orum** ;
Cesare, Camestres, Festino, Baroco ; Darapti,
Felapton, Disamis, Datisi, Bocardo, Ferison.

An *indirect* mood is one in which we infer only the converse of the immediate conclusion.

very little, since it contains a complete inversion of the order of thought. This is the ground on which it is, for instance, rejected by Thomson.* This figure is far less effective than Figure 1 and states the argument in an unnatural way. But all the same we have to recognise it for the completeness of our theory.†

The uses of the four figures are summarised by Lambert † in the statement that the First Figure is suited to the proof of the properties of a thing; the Second is suited to the proof of the distinctions or differences between things; the Third to the production of instances and exceptions; and the Fourth to the discovery or exclusion of the species of a genus.

7. Axioms or Dicta of the Imperfect Figures.— The axiom of the First Figure (the "Perfect" Figure), known as the *Dictum de Omni et Nullo*, has already been enunciated. As other figures can be reduced to the

* "In the fourth figure the order of thought is wholly inverted, the subject of the conclusion had only been a predicate, whilst the predicate had been the leading subject in the premiss. Against this the mind rebels." Thomson, *Laws of Thought*, p. 178. "What is called the Fourth Figure is only the First with a converted conclusion; that is, we do not actually reason in the Fourth, but only in the First, and then if occasion requires, convert the conclusion of the First." —Bowen, *Logic*, p. 92.

† "The moods in the fourth figure represent no natural form of reasoning, and were only invented for the sake of ringing the verbal changes exhaustively"—A. Sidgwick, *op. cit.* p. 80.

‡ Lambert, *Neues Organon* (1764).

First, this axiom is by itself sufficient as the basis of all syllogistic reasoning. But some logicians hold that each figure has its own *dictum*. These *dicta* have been variously stated. The axiom of the Second Figure is known as *Dictum de Diverso*, which may be enunciated as follows :—

“ If one term is contained in, and another excluded from, a third term, they are mutually excluded.”

or

“ If a whole class is included in, or excluded from, a second class, the same relation holds good with respect to each part of the whole class.”

The axiom of the Third Figure is called the *Dictum de Exemplo et de Excepto*, and may be stated thus :—

“ Two terms which contain a common part partly agree ; or, if one contains a part which is excluded from the other, they partly differ.”

The axiom of the Fourth Figure is known as the *Dictum de Reciproco*, but its statement is so cumbrous that it may as well be left out.

8. Tables of Moods in the Four Figures.—We give below a tabular statement of the possible pairs of premisses and the resultant moods in each Figure, and where the premisses yield no conclusion we state the General Rule whereby no conclusion is possible. If more than one Rule is violated, only the first in

order is referred to. Under each *valid* mood, the mnemonic symbol is also given:

FIRST FIGURE.

All M is P	All M is P	All M is P	All M is P
All S is M	No S is M	Some S is M	Some S is not M
∴ All S is P	(Rule 9)	∴ Some S is P	(Rule 9)
<i>Barbara</i>		<i>Darii</i>	
No M is P	No M is P	No M is P	No M is P
All S is M	No S is M	Some S is M	Some S is not M
∴ No S is P	(Rule 5)	∴ Some S is not P	(Rule 5)
<i>Celarent</i>		<i>Ferio</i>	
Some M is P	Some M is P	Some M is P	Some M is P
All S is M	No S is M	Some S is M	Some S is not M
(Rule 3)	(Rule 9)	(Rule 3)	(Rule 7)
Some M is not P	Some M is not P	Some M is not P	Some M is not P
All S is M	No S is M	Some S is M	Some S is not M
(Rule 3)	(Rule 5)	(Rule 3)	(Rule 5)

SECOND FIGURE.

All P is M	All P is M	All P is M	All P is M
All S is M	No S is M	Some S is M	Some S is not M
(Rule 3)	∴ No S is P	(Rule 3)	∴ Some S is not P
	<i>Camestres</i>		<i>Baroco</i>
No P is M	No P is M	No P is M	No P is M
All S is M	No S is M	Some S is M	Some S is not M
∴ No S is P	(Rule 5)	∴ Some S is not P	(Rule 5)
<i>Cesare</i>		<i>Festino</i>	
Some P is M	Some P is M	Some P is M	Some P is M
All S is M	No S is M	Some S is M	Some S is not M
(Rule 3)	(Rule 9)	(Rule 3)	(Rule 7)
Some P is not M	Some P is not M	Some P is not M	Some P is not M
All S is M	No S is M	Some S is M	Some S is not M
(Rule 9)	(Rule 5)	(Rule 7)	(Rule 5)

THIRD FIGURE.

All M is P	All M is P	All M is P	All M is P
All M is S	No M is S	Some M is S	Some M is not S
∴ Some S is P	(Rule 9)	∴ Some S is P	(Rule 9)
<i>Darapti</i>		<i>Datisi</i>	
No M is P	No M is P	No M is P	No M is P
All M is S	No M is S	Some M is S	Some M is not S
∴ Some S is not P	(Rule 5)	∴ Some S is not P	(Rule 5)
<i>Felapton</i>		<i>Ferison</i>	
Some M is P	Some M is P	Some M is P	Some M is P
All M is S	No M is S	Some M is S	Some M is not S
∴ Some S is P	(Rule 9)	(Rule 3)	(Rule 3)
<i>Disamis</i>			
Some M is not P	Some M is not P	Some M is not P	Some M is not P
All M is S	No M is S	Some M is S	Some M is not S
∴ Some S is not P	(Rule 5)	(Rule 3)	(Rule 3)
<i>Bocardo</i>			

FOURTH FIGURE.

All P is M All M is S \therefore Some S is P <i>Bramantip</i>	All P is M No M is S \therefore No S is P <i>Camenes</i>	All P is M Some M is S \therefore Some S is not P <i>Fesapo</i>	All P is M Some M is not S \therefore Some S is not P <i>Fresison</i>
No P is M All M is S \therefore Some S is not P <i>Fesapo</i>	No P is M No M is S \therefore Some S is not P <i>Fresison</i>	No P is M Some M is S \therefore Some S is not P <i>Fesapo</i>	No P is M Some M is not S \therefore Some S is not P <i>Fresison</i>
Some P is M All M is S \therefore Some S is P <i>Dimaris</i>	Some P is M No M is S \therefore Some S is not P <i>Dimaris</i>	Some P is M Some M is S \therefore Some S is not P <i>Fesapo</i>	Some P is M Some M is not S \therefore Some S is not P <i>Fesapo</i>
Some P is not M All M is S \therefore Some S is not P <i>Dimaris</i>	Some P is not M No M is S \therefore Some S is not P <i>Dimaris</i>	Some P is not M Some M is S \therefore Some S is not P <i>Fesapo</i>	Some P is not M Some M is not S \therefore Some S is not P <i>Fesapo</i>

9. Pure Hypothetical and Pure Disjunctive Syllogisms.—We might, very briefly, consider Figure and Mood in (a) Pure Hypothetical and (b) Pure Disjunctive Syllogisms.*

(a) *Pure Hypothetical Syllogisms*.—We have already said that all the Rules of the Categorical Syllogism apply to Pure Hypothetical Syllogisms; hence distinctions of figure and mood are recognised in the same way as in the case of the Categorical Syllogism. The antecedent of the conclusion corresponds to the *minor term* of the Categorical Syllogism, the consequent of the conclusion to the *major term*, and the element which does not appear in the conclusion to the *middle term*. Only the corresponding forms of *Barbara* are important. We give a few examples:—

Fig. 1.—Corresponding to *Barbara* :—

If any S is X, that S is P;
If any S is M, that S is X
 \therefore If any S is M, that S is P.

If any person has headache, he is sick,
If any person overworks, he has headache;
 \therefore If any person overworks, he is sick.

* Cf. Welton, *op. cit.* I. 348 ff. Keynes, *Studies and Exercises in Formal Logic* (1884) p. 228.

Fig. 2.—Corresponding to *Cesare* :—

If any S is P, then never is it X ;
 If any S is M, then always is it X ;
 ∴ If any S is M, then never is it P.

If a person commits murder, it is never justifiable ;
 If a person shoots in self-defence, it is always justifiable ;
 ∴ If a person shoots in self-defence, it is not committing murder.

Fig. 3.—Corresponding to *Bocardo*.

If an S is X, then sometimes it is not P ;
 If any S is X, then always it is M ;
 ∴ If an S is M, then sometimes it is not P.

If a man is rich, sometimes he is not happy ;
 If a man is rich, he is always comfortable ;
 ∴ If a man is comfortable, sometimes he is not happy.

Fig. 4.—Corresponding to *Bramantip* :—

If any S is P, then always it is X ;
 If any S is X, then always it is M ;
 ∴ If any S is M, then sometimes it is P.

If any legislative measure is unpopular it is always opposed by majority ;
 If any legislative measure is opposed by majority, it is always lost ;
 ∴ If any legislative measure is lost, it is sometimes unpopular.

(b) *Pure Disjunctive Syllogisms* :—No disjunctive proposition can be negative ; hence Pure Disjunctive Syllogisms must always be in the affirmative form. Thus all negative moods are rejected ; and of the affirmative moods, only one, viz., *Barbara*, is important. We must also remember that a conclusion can only be drawn if one of the alternatives in the minor premiss

of a Pure Disjunctive Syllogism negatives an alternative of the major premiss, e.g.

S is either P or Y ;
 S is either \bar{P} or Z ;
 ∴ S is either Y or Z.

10. Hints on the Working Out of Syllogistic Problems.—There are three ways of working out syllogistic problems : (1) by applying the General Rules of the Syllogism, (2) by means of the Special Rules of each Figure, and (3) by the mnemonic lines. The first is the best and the neatest method, and its use is always allowable. The second method need not always be used ; as a matter of fact, it never commends itself as a substitute of the first method. The third method is purely mechanical and has hardly any educational value. It is, however, useful in verifying the results, arrived at by the first method. Hence, the student should remember that—

- (i) The General Rules of the Syllogism may always be applied without reservation. These can be taken for granted in the working out of exercises.
- (ii) When general data are given, with no specific reference to figure or mood, we should find out the position of the *middle term* by reference to the General Rules only. This will lead us to the discovery of the figure or figures in which the given data are fulfilled.

- (iii) The Special Rules of the Four Figures should not take the place of the General Syllogistic Rules. There is no objection to the indirect help derived from the former.
- (iv) The mnemonic lines also should not be used as a substitute for the General Rules, through which alone answers should be discovered. The correctness of such answers may, however, be tested by reference to the mnemonic verses. These verses are to be used only for identification and reference.
- (v) The given data of a problem should be developed step by step in order to find out their solution. The solution should unfold itself by developing the implications of the given data. The method of merely testing a number of moods to see if the given conditions are fulfilled in any of them cannot be recommended, chiefly because it hardly involves any mental effort and is no better than an experiment or a mechanical exercise.
- (vi) The application of the Rules may proceed in the following order :—(1) Count the terms and propositions (Rules 1 and 2), (2) See if M is rightly distributed (Rules 3 and 4), (3) Illicit Processes, (4) Apply the rules concerning the negatives, (5) See if the mood is subaltern.

11. Typical Exercises Worked Out.—

(1) Given the following pairs of premisses, state the conclusion that follows in each case :—

(i) All students are industrious ; { All M is P ;
All students are sportsmen ; { All M is S ;

(Here we have AA in the third figure. Therefore the conclusion is 'Some S is P' or 'Some sportsmen are industrious' (*Darapti*);

(ii) Some members are voters ; { Some P is M.
All voters are privileged persons } All M is S ;

(Here we have IA in Fig. 4 ; hence the conclusion is I, 'Some S is P' or 'Some privileged persons are members' (*Dimaris*)).

(iii) All P is M
No M is S

(Here we have AE in Fig. 4. Therefore the conclusion is 'No S is P' (*Camenes*)).

(2) What rule of the syllogism is broken by the following moods, no regard being paid to figure ?

AAE breaks Rule 6.

AAO , , 6.

AEA , , 6.

AOI , , 6.

EAA , , 6.

IOO , , 7.

III , , 7.

EEO , , 5.

OOA , , 5.

AIA , , 8.

(3) Prove that in the premisses there must always be one distributed term more than in the conclusion.

Proof: Even if no term is distributed in the conclusion, the middle term must be distributed in the premisses (Rule 3). And if either S or P is distributed in the conclusion, it must also be distributed in the premisses (Rule 4) in addition to the middle term.

(4) If the middle term is distributed in both premisses, what can we infer as to the conclusion?

Both premisses cannot be negative (Rule 5); hence the possible cases are (i) both premisses may be affirmative, (ii) one of the premisses may be negative.

In case (i) the minor term cannot be distributed, since, by hypothesis, the middle term is distributed twice in the premisses—and in this case no more than two terms can be distributed in the two premisses together. Hence the conclusion must be particular.

In case (ii) where one premiss is negative, three terms can be distributed in the two premisses together. As the middle term is distributed twice, it follows that either the major or the minor term must also be distributed. But the conclusion must be negative (Rule 6) hence the major term (its predicate) must be distributed in it, and therefore must be distributed in the major premiss as well (Rule 4). The minor term cannot, therefore, be distributed in the premisses; hence the conclusion must be particular.

Thus in either case the conclusion must be particular.

(5) Give reasons to show that the two moods EAO and EIO are valid in all the four figures.

In other words we have to prove that the pairs EA and EI with O conclusion are valid in all figures.

Now, as we have E as the major premiss, it will therefore distribute both subject and predicate, and P may be either subject or predicate. Thus the major premiss may be either MP or PM and both M and P must be distributed in it. Consequently, M need not be distributed in the minor premiss, which may be either A or I, and in it S cannot be distributed, since S is undistributed in the conclusion. P is distributed in the conclusion, and therefore must also be distributed in the major premiss.

Hence the major premiss may be MP or PM, when both M and P are distributed; and the minor premiss MS or SM, in which M need not be distributed. Thus—

	Fig. 1	Fig. 2	Fig. 3	Fig. 4
EAO	$\overset{\circ}{M} \overset{\circ}{P}$	$\overset{\circ}{P} \overset{\circ}{M}$	$\overset{\circ}{M} \overset{\circ}{P}$	$\overset{\circ}{P} \overset{\circ}{M}$
	$\overset{\circ}{S} M$	$\overset{\circ}{S} M$	$\overset{\circ}{M} S$	$\overset{\circ}{M} S$
EIO	$\therefore S \overset{\circ}{P}$	$\therefore S \overset{\circ}{P}$	$\therefore S \overset{\circ}{P}$	$\therefore S \overset{\circ}{P}$
	$\overset{\circ}{M} \overset{\circ}{P}$	$\overset{\circ}{P} \overset{\circ}{M}$	$\overset{\circ}{M} \overset{\circ}{P}$	$\overset{\circ}{P} \overset{\circ}{M}$
	$S M$	$S M$	$M S$	$M S$
	$\therefore S \overset{\circ}{P}$	$\therefore S \overset{\circ}{P}$	$\therefore S \overset{\circ}{P}$	$\therefore S \overset{\circ}{P}$

(Here the terms on which a small circle is placed indicate that they are distributed.)

(6) Prove that it is only the first Figure that yields an A conclusion.

If the conclusion is A (universal affirmative), the premisses must also be universal affirmative, and therefore distribute their subjects only.

Again, if the conclusion is A, its subject S must be distributed; hence it must also be distributed in the minor premiss (Rule 4), and must, therefore, be the subject in this case. Hence M must be distributed in the major premiss (Rule 3), of which it must therefore be the subject. Thus we arrive at the scheme.

MaP

SaM

SaP

which is *Barbara* in Fig. 1.

(7) Examine the validity of the following moods:—

AEE, OAO, AOO in Fig. 1,

AAA, OAO, IAI in Fig. 2,

AAA, EAE, AEO in Fig. 3,

AEO, OAO, AII in Fig. 4.

In examining the validity of any mood in a given figure, we should proceed as follows:—(1) Draw out the symbolic form of the given figure, i.e., set down the arrangement of the terms. (2) Put down the propositions of the mood along the premisses and the conclusion. (3) Mark the terms which are distributed. The fault, if any, will thus appear by itself.

Now, let us examine the given moods in order :—

(i) AEE in Fig. 1 :—

$\frac{\text{M } \text{P}}{\text{S } \text{M}} \text{ A}$ distributes subject only.

$\frac{\text{S } \text{M}}{\text{S } \text{P}} \text{ E}$ „ subject and predicate.

$\text{S } \text{P}$ „ „ „

We see at once that P is distributed in the conclusion but is undistributed in the major premiss. Hence this mood is invalid in Fig. 1, and involves *Illicit Process of the Major Term*.

(ii) OAO in Fig. 1 :—

$\frac{\text{M } \text{P}}{\text{S } \text{M}} \text{ O}$ distributes predicate only.

$\frac{\text{S } \text{M}}{\text{S } \text{P}} \text{ A}$ „ subject „

$\text{S } \text{P}$ „ predicate „

We see that M is not distributed at all ; hence the mood is invalid and involves the fallacy of *Undistributed Middle*.

(iii) AOO in Fig. 1 :—

$\frac{\text{M } \text{P}}{\text{S } \text{M}} \text{ A}$ distributes subject only.

$\frac{\text{S } \text{M}}{\text{S } \text{P}} \text{ O}$ „ predicate „

$\text{S } \text{P}$ „ „ „

P is distributed in the conclusion but is undistributed in the major premiss. Hence it involves *Illicit Process of the Major*.

(iv) AAA in Fig. 2 :—

$\frac{\text{P } \text{M}}{\text{S } \text{M}} \text{ A}$ distributes subject only.

$\frac{\text{S } \text{M}}{\text{S } \text{P}} \text{ A}$ „ „ „

$\text{S } \text{P}$ „ „ „

Fallacy of *Undistributed Middle*.

(v) OAO in Fig. 2 :—

P $\overset{\circ}{M}$ O distributes predicate only.

$\frac{\overset{\circ}{S} \overset{\circ}{M}}{S \overset{\circ}{P}}$ A ,,, subject ,,,

S $\overset{\circ}{P}$ O ,,, predicate ,,,

Illicit Process of the Major.

(vi) IAI in Fig. 2 :—

P M I distributes neither.

$\frac{\overset{\circ}{S} \overset{\circ}{M}}{S \overset{\circ}{P}}$ A ,,, subject only.

I ,,, neither.

Undistributed Middle.

(vii) AAA in Fig. 3 :—

$\overset{\circ}{M} P$ A distributes subject only.

$\frac{\overset{\circ}{M} S}{\overset{\circ}{S} \overset{\circ}{P}}$ A ,,, ,,, ,,,

A ,,, ,,, ,,,

The minor term S is distributed in the conclusion but undistributed in the premiss ; hence the fallacy is *Illicit Process of the Minor.*

(viii) EAE in Fig. 3 :—

$\overset{\circ}{M} \overset{\circ}{P}$ E distributes both.

$\frac{\overset{\circ}{M} S}{\overset{\circ}{S} \overset{\circ}{P}}$ A ,,, subject only.

E ,,, both.

Illicit Process of the Minor.

(ix) AEO in Fig. 3 :—

$\overset{\circ}{M} P$ A distributes subject only.

$\frac{\overset{\circ}{M} \overset{\circ}{S}}{S \overset{\circ}{P}}$ E ,,, both.

O ,,, predicate only.

Illicit Process of the Major.

(x) AEO in Fig. 4 :—

$$\begin{array}{l} \text{P} \quad \text{M} \quad \text{A} \quad \text{distributes subject only.} \\ \text{M} \quad \text{S} \quad \text{E} \quad \text{,, both.} \end{array}$$
$$\begin{array}{l} \text{S} \quad \text{P} \quad \text{O} \quad \text{,, predicate only.} \end{array}$$
This mood is valid. It is a *subaltern* mood.

(xi) OAO in Fig. 4 :—

$$\begin{array}{l} \text{P} \quad \text{M} \quad \text{O} \quad \text{distributes predicate only.} \\ \text{M} \quad \text{S} \quad \text{A} \quad \text{,, subject ,,} \end{array}$$
$$\begin{array}{l} \text{S} \quad \text{P} \quad \text{O} \quad \text{,, predicate ,,} \end{array}$$
Illicit Process of the Major.

(xii) AII in Fig. 4 :—

$$\begin{array}{l} \text{P} \quad \text{M} \quad \text{A} \quad \text{distributes subject only.} \\ \text{M} \quad \text{S} \quad \text{I} \quad \text{,, neither.} \end{array}$$
$$\begin{array}{l} \text{S} \quad \text{P} \quad \text{I} \quad \text{,, ,} \end{array}$$
Undistributed Middle.

(8) Prove that in each figure, if the minor premiss be negative, the major must be universal.

The minor premiss is negative ; therefore the major must be affirmative (Rule 5), and the conclusion must be negative (Rule 6) and so the major term must be distributed in it ; and consequently it must be distributed in the major premiss as well (Rule 4). Hence the major premiss must be A.

(9) Prove that if one premiss of a syllogism is O, the other must be A.

Two particular premisses prove nothing (Rule 7) ; therefore, if one premiss is O, the other must be *universal* ; and it must also be *affirmative* (Rule 5). Hence it must be A.

(10) Show that in the First and Fourth Figures neither premiss can be O.

In Fig. 1 :—(a) If the major premiss is O, the conclusion must be negative (Rule 6), and therefore P must be distributed in it, and consequently in the major premiss as well (Rule 4). But the minor premiss is A, and therefore must distribute the subject only. Thus :—

$$\begin{array}{l} \text{M} \overset{\circ}{\text{P}} \text{ O distributes predicate only.} \\ \text{S} \overset{\circ}{\text{M}} \text{ A} \quad \text{,,} \quad \text{subject} \quad \text{,,} \\ \hline \text{S} \overset{\circ}{\text{P}} \end{array}$$

It results in the fallacy of *Undistributed Middle*; hence O cannot be the major premiss.

(b) If the minor premiss is O, we must even then have a negative conclusion (Rule 6), which will distribute P.

$$\begin{array}{l} \text{M} \overset{\circ}{\text{P}} \text{ A distributes subject only.} \\ \text{S} \overset{\circ}{\text{M}} \text{ O} \quad \text{,,} \quad \text{predicate} \quad \text{,,} \\ \hline \text{S} \overset{\circ}{\text{P}} \end{array}$$

We have here *Illicit Process of the Major*. Therefore, O cannot be the minor premiss.

Thus in Fig. 1 neither premiss can be O.

*In Fig. 4 :—*If either premiss is O, then P must be distributed in the conclusion. Neither the major nor the minor premiss can be O, as is evident in the following schemes :—

$$\begin{array}{l} \text{P} \overset{\circ}{\text{M}} \text{ O distributes predicate only.} \\ \text{M} \overset{\circ}{\text{S}} \text{ A} \quad \text{,,} \quad \text{subject} \quad \text{,,} \\ \hline \text{S} \overset{\circ}{\text{P}} \end{array}$$

The result is *Illicit Major*.

$$\begin{array}{rcl}
 \overset{\circ}{P} \overset{\circ}{M} & A & \text{distributes subject only.} \\
 \overset{\circ}{M} \overset{\circ}{S} & O & \text{,, predicate ,,} \\
 \hline
 \overset{\circ}{S} \overset{\circ}{P}
 \end{array}$$

The result is *Undistributed Middle*.

Hence, in Fig. 4 also, neither premiss can be O.

(11) Construct a syllogism to prove that 'Some men are logicians.'

Hints as to procedure :—(a) When no particular figure is specified draw out the scheme of Fig. 1, the mood to be determined by the given conclusion. Find out the major and the minor terms from the conclusion. Place these terms in their proper places and find a suitable middle term to complete the argument.

(b) When a mood is specified, draw out the scheme accordingly, fill in the major and minor terms and then find a suitable term to complete the argument.

Now let us construct a syllogism to prove that 'Some men are logicians.'

Obviously S=men, and P=logicians. The conclusion I in Fig. 1 is to be found in *Darii*; thus we arrange :—

A All (M) are logicians.
 I Some men are (M).
 I \therefore Some men are logicians.

We have to find a suitable middle term and the argument is complete. This may be, e.g., 'exact thinkers.' Thus we have :—

All exact thinkers are logicians ;
 Some men are exact thinkers ;
 \therefore Some men are logicians.

(12) Construct a syllogism to prove that 'Some rich persons are not happy.'

E No ambitious persons are happy;
 I Some rich persons are ambitious;
 O ∴ Some rich persons are not happy.

Ferio in Fig. 1.

(13) Test the following argument:—

Every innocent thing is allowable;
 Some pleasures are not innocent;
 ∴ Some pleasures are not allowable.

Here the conclusion O distributes its predicate 'allowable,' which must, therefore, be distributed in the major premiss as well (Rule 4). But as the major premiss is A, it can distribute the subject only. Hence the argument is invalid and commits the fallacy of *Illicit Major*.

It may be symbolically expressed as—

$\begin{array}{c} \text{M} \text{a} \text{P} \\ \text{S} \text{o} \text{ } \text{M} \\ \hline \text{∴ S} \text{o} \text{P} \end{array}$ AOO in Fig. 1
is invalid.

(14) Test the argument:—

All who live beyond their income are thoughtless;
 Some Barristers are thoughtless;
 ∴ Some Barristers live beyond their income.

Symbolically expressed, it is.—

$\begin{array}{c} \text{P} \text{a} \text{M} \\ \text{S} \text{i} \text{M} \\ \hline \text{∴ S} \text{i} \text{P} \end{array}$ This is in Fig. 2, and involves the fallacy of *Undistributed Middle*.

(15) Test the following argument :—

All conceited men are vain ;

All vain men are fools ;

∴ All fools are conceited.

This argument may be expressed thus :—

$\overset{\circ}{P} a M$ distributes subject only.

$\overset{\circ}{M} a S$ „ „ „

∴ $\overset{\circ}{S} a P$ „ „ „

Fallacy of *Illicit Minor*.

(16) Test the arguments :—

(i) Some towns are fortified ;

· Berlin is a town ;

∴ Berlin is fortified.

The argument is faulty, as two particular premisses prove nothing (Rule 7).

(ii) All statesmen are men of learning ;

All men of learning are wise ;

∴ All wise men are statesmen.

This may be symbolically expressed as—

$P a M$ The argument is AAA in Fig. 4, and

$M a S$ involves *Illicit Process of the Minor*.

∴ $S a P$

(iii) He that calls you an animal speaks the truth,

He that calls you a goose calls you an animal ;

∴ He that calls you a goose speaks the truth ;

Here the middle term 'calls you an animal' is ambiguous and has a different meaning in each premiss :

in the major it means 'actually calls you an animal,' in the minor 'implies that you are an animal.' Hence we have the fallacy of *Ambiguous Middle or Four Term*, (violation of Rule 1).

(iv) All false friends are to be dreaded ;

Some false friends are pleasant companions ;

∴ Some pleasant companions are to be dreaded.

This argument may be stated as—

$\frac{\text{M}a\text{P}}{\text{M}i\text{S}}$ This is AII in Fig. 3 and is valid.

$\frac{\text{M}i\text{S}}{\text{S}i\text{P}}$ No syllogistic rule is violated.

SUMMARY.

Figure is the form of a syllogism determined by the position of the Middle Term ; while **Mood** is the form in respect of the quantity and quality of the Proposition which compose it.

The number of Figures is determined by the number of ways in which the position of the middle term can be varied in the premisses. M may be subject of the major and predicate of the minor (Fig. 1), or predicate of both (Fig. 2), or subject of both (Fig. 3), or the reverse of Fig. 1 (Fig. 4).

As a syllogism consists of three propositions, the number of its possible moods is the permutation of 4 things (A, E, I, O) taken 3 at a time, viz., 64. Of these sixteen are rejected by Rule 5 ; sixteen by Rule 6 ; twelve by Rule 7 ; eight by Rule 8 ; and one (viz., IEO)

by Rule 4. The remaining 11 valid moods are AAA, AAI, AEE, AEO, AII, AOO, EAE, EAO, EIO, IAI and OAO.

Special Rules of the four figures :—

<i>Figure.</i>	<i>Rules.</i>	<i>Proofs.</i>
1	(a) Minor premiss affirmative ... Or, Illicit Major. (b) Major premiss universal ... Or, Undistributed Middle.	
2	(a) One premiss negative ... Or, Undistributed Middle. (Conclusion negative) ... ∵ Premiss negative.	
	(b) Major premiss universal ... Or, Illicit Major.	
3	(a) Minor premiss affirmative ... Or, Illicit Major. (b) Conclusion particular ... Or, Illicit Minor.	
4	(a) Major premiss not O ... Or, Illicit Major. (b) Minor premiss not O ... Or, Undistributed Middle, (c) Conclusion not A ... Or, Illicit Minor.	

By the application of these *special rules* we can easily determine the **VALID MOODS IN EACH FIGURE**. They are :—

FIG. 1.—AAA, AII, EAE, EIO (*plus* AAI and EAO, which are subaltern moods, and are included in AAA and EAE respectively).

FIG. 2.—AEE, AOO, EAE, EIO (*plus* AEO and EAO, which are included in AEE and EAE respectively).

FIG. 3.—AAI, AII, EAO, EIO, IAI, OAO.

FIG. 4.—AAI, AEE, EAO, EIO, IAI (*plus* AEO, which is included in AEE).

Thus we discover 19 valid moods of the syllogism in the four figures taken together, and these

are ingeniously stated in the famous mnemonic verses.

Characteristics of the Four Figures :—

FIG. 1.—Called by Aristotle the “*Perfect*” Figure.

It is the only figure (i) which can prove all four forms A, E, I, O (ii) which can prove A (hence it is the most important) ; and it is the most natural form of reasoning.

FIG. 2.—Proves only negatives ; and is called the *Exclusive* Figure.

FIG. 3.—Proves only *particulars*, and is the only natural figure for expressing arguments in which the middle term is singular.

It has been called the *Inductive* figure.

FIG. 4.—Discovers the species of a genus. It was not recognised by Aristotle. “ It is not an independent type ; its first three moods are merely moods of the first figure with the conclusion converted, as the process of reducing them assumes ; its last two moods draw conclusions which are shown to be valid most naturally by reduction to the third figure.’ (Joseph, p. 290).

Dicta of the Four Figures :—

FIG. 1.—*Dictum de Omni et Nullo* :—“ Whatever is predicated (affirmed or denied) of a whole class, may be predicated in like manner of any part of it.”

FIG. 2.—*Dictum de Diverso* :—“ If one term is contained in, and an other excluded from, a third term, they are mutually exclusive.”

FIG. 3.—*Dictum de Exemplo et de Excepto* :—“ Two terms which contain a common part partly agree ; or, if one contains a part which is excluded from the other, they partly differ.”

FIG. 4.—*Dictum de Reciproco* :—“ If no M is B, no B is this or that M : if C is not this or that B, there are B's which are or are not C.” (Lambert).

Table of Categorical Syllogism—

MOOD.	FIG. 1	FIG. 2	FIG. 3	FIG. 4
AAA	Valid.	Undistributed Middle.	Illicit Minor.	Illicit Minor.
AAI	Do.	Do. ...	Valid.	Valid.
AEE	Illicit Major.	Valid.	Illicit Major.	Do.
AEO	Do.	Do.	Do.	Do.
AII	Valid.	Undistributed Middle.	Valid.	Undistributed Middle.
AOO	Illicit Major.	Valid.	Illicit Major.	Do.
EAE	Valid.	Do.	Illicit Minor.	Illicit Minor.
EAO	Do.	Do.	Valid.	Valid.
EIO	Do.	Do.	Do.	Do.
IAI	Undistributed Middle.	Undistributed Middle.	Do.	Do.
OAO	Do.	Illicit Major.	Do.	Illicit Major.

Notice that AAA is valid in Fig. 1 only ; AOO in Fig. 2 only ; OAO in Fig. 3 only ; and EAO and EIO are valid in all figures.

CHAPTER VI.

REDUCTION.

1. **Problem of Reduction.**—We have already said that Aristotle laid down the basis of all syllogistic reasoning in the *Dictum de Omni et Nullo*. The validity of any argument was to be tested by its conformity to this axiom. But only the First Figure agrees directly with this principle. Hence Aristotle felt the need of formulating some method by which arguments in the "Imperfect" figures could be transformed in the "Perfect" figure, in order that the *Dictum* may be applied to them. The *Dictum* covers all the valid moods in Fig. 1, hence in order to apply it to moods in the other figures, they must be "reduced" to their corresponding moods in Fig. 1. The process of transforming a syllogism in any of the other figures in the form of a syllogism of the First Figure is called **Reduction**. In a wider sense, however, Reduction may be defined as the process of restating a given argument into another form. But it is usual to restrict it to its narrower meaning: given an argument in the Second, Third or Fourth Figure, how to transform it in the First Figure: this constitutes the problem of Reduction. The given mood, which is to be transformed, is called the *reducend*, while that to which it is reduced, the *reduct*. Reduction has hardly any significance for those logicians who do not follow Aristotle in adopting the *Dictum de*

Omni et Nullo as the basis of all syllogistic inference but hold that each figure is suited to its own characteristic functions and is based on its own *dictum*. On the other hand, the doctrine of Reduction is extremely important in the system of Aristotle and in scholastic logic. We shall discuss its function and value after we have explained the process in some details.

2. Kinds of Reduction.—Reduction is of two kinds : (i) Direct or Ostensive, (ii) Indirect or *Per Impossibile* (or *ad absurdum*). **Direct or Ostensive Reduction** consists in showing that the original conclusion follows from premisses derived from those given. The process shows that the moods in the Second, Third and Fourth Figures have one or the other corresponding mood in the First Figure, and consequently prove that all those moods essentially conform to the *Dictum de Omni et Nullo*. It requires us not to introduce any new term or proposition in the *reduct*. As the formal validity of a proposition is not affected by education, it is obvious that in direct Reduction we are at liberty to change the original premisses of the given syllogism by conversion, transposition, or obversion.

The other kind, called **Indirect Reduction**, or *Reduction per Impossibile* or *Reductio ad absurdum*, or *Demonstratio* (or *Deductio*) *per* (or *ad*) *Impossibile* (or *absurdum*), is essentially equivalent to Indirect Proof, and consists in proving the truth or validity of a syllogistically inferred conclusion in an 'imperfect figure' by showing

that if we admit its falsity, it will result in an impossibility or absurdity, *i.e.*, by showing that the contradictory of the conclusion is *false* (hence the conclusion must be true). In other words, to establish the truth of a conclusion by this method, we begin by assuming that it is not true—hence it follows that its contradictory must be true, but this leads to contradiction with the truth of the given premisses. Hence we conclude that the assumption of the denial of the given conclusion must be false; *i.e.*, the conclusion must be true.

Before we illustrate these two methods let us refer once more to the famous mnemonic lines, and see if they also help us in solving the problem of Reduction.

3. **Explanation of the Mnemonic Lines.**—One of the purposes of constructing the mnemonic verses was to lay down an ingenious method of reduction. We have already said that the three vowels in each of these barbarous names denote the quality and quantity of the major premiss, the minor premiss, and the conclusion respectively. But besides the vowels, there are several consonants as well. The initial letters of the moods are the first four consonants of the alphabet, *viz.*, B, C, D, F; and mark the mood in the First Figure to which those in the other figures are to be reduced, *i.e.*, *Bramantip* is to be reduced to *Barbara*, *Festino* to *Ferio*, *Datisi* to *Darii*, and so on. The consonants 's' and 'p' signify that the proposition denoted by the preceding vowel is to be converted (s) simply or (p) *per accidens* (except when they occur after the third vowel

of a word, *viz.*, the conclusion).* Thus *Cesare* is reduced to *Celarent* by simple conversion of E (here the major premiss) :—

<i>Cesare.</i>	<i>Celarent.</i>
P e M	M e P
S a M	S a M
∴ <u>S e P</u>	∴ <u>S e P</u>

and *Fesapo* becomes *Ferio* :—

<i>Fesapo.</i>	<i>Ferio.</i>
P e M	M e P
M a S	S i M
∴ <u>S o P</u>	∴ <u>S o P</u>

By conversion *per accidens* we reduce, *e.g.*, *Darapti* to *Darii* :—

<i>Darapti.</i>	<i>Darii.</i>
M a P	M a P
M a S	S i M
∴ <u>S i P</u>	∴ <u>S i P</u>

Bramantip to *Barbara* :—

P a M		M a S
M a S		P a M
∴ <u>S i P</u>		∴ <u>P a S</u>
		∴ <u>S i P</u> (conversion
		<i>per accidens</i>).

*But when *S* and *P* occur at the end of a word, *e.g.*, in *Camestres*, *Disamis*, *Camenes*, *Dimaris*, *Bramantip*, they signify that the *new* conclusion obtained by reduction is to be converted 'simply' or *per accidens* respectively. Thus the final *p* in *Bramantip* indicates that the A conclusion obtained in Fig. 1 by reducing it to *Barbara* is to be converted *per accidens* to arrive at the I conclusion of the given syllogism in Fig. 4.

The letter *m* indicates (metathesis) that the premisses are to be transposed, as we have shown in *Bramantip*.

The letter *c* indicates *conversio syllogismi* (i.e., change of the syllogism, and signifies that the mood is to be reduced *indirectly* (i.e., by *reductio per impossibile*). The position of the letter points to the steps to be taken in this process, *viz.*, first omit the premiss preceding the letter, and then join the other premiss to the contradictory of the conclusion. This letter occurs in two moods only, *viz.*, *Baroco* and *Bocardo*. Some writers use *k* instead of *c*, and write these moods as *Baroko*, *Bokardo*.*

Of the remaining consonants, *l*, *n*, *r* and *t* are meaningless; and *b* and *d*, when not initial letters, are also non-significant.

Many attempts have been made to improve the form of these words:† the one made by Prof. Carveth Read ‡ deserves notice. In the following version of the mnemonics he aims at getting rid of all meaningless

* It is also possible, as we shall show presently, to reduce these two moods *directly*. In that case their names will have to be changed. *Baroco* will be replaced by the name *Faksoko*, and *Bocardo* by *Deksamosk*, where the letter *k* would indicate obversion of the preceding proposition, and *ks* contraposition.

† For moods in Fig. 4, e.g., Wallis suggests the names *Balani*, *Cadere*, *Digami*, *Fegano*, *Fedibo*; and P. van Musschenbroek gives *Barbari*, *Calentes*, *Dibatis*, *Fespamo*, *Fresisom*. Cf. Keynes, *op. cit.* p. 184.

‡ Announced by him first in *Mind* of 1882 p. 440, and incorporated in his *Logic, Deduction and Induction* (vide, 2nd ed. 1901, p. 127).

letters, and at showing by the name of each Mood the Figure to which it belongs, and at the same time suggesting names for the *direct* reduction of *Baroco* and *Bocardo* :—

Balala, Celalel, Dalii, Felio que prioris

*Cesane, Camenes, Fesinon, { Faksnoko secundæ :
Banoco*

Tertia Darapti, Drisamis, Darisi, Ferapro,

Doksamrosk } , *Ferisor* habet: *Quarta* insuper addit
Bocaro }

Bamantip, Cametes, Dimatis, Fesapto, Fesistot.

In those lines l is the sign of Fig. 1, n of Fig. 2, r of Fig. 3, and t of Fig. 4.

4. Examples of Direct Reduction.—We shall now take all the valid moods of the second, third and fourth figures and show their *ostensive reduction* to equivalent moods in the First Figure:—

FIGURE 2.

(i) *Cesare* to *Celarent* :—

No P is M	—	No M is P
All S is M		All S is M
∴ <u>No S is P</u>		∴ <u>No S is P</u>

(ii) *Camestres to Celarent* :—

All P is M No M is S
 No S is M All P is M
 ∴ No S is P ∴ No P is S
 ∴ No S is P

Here the order of the premisses is changed (*m*) and the minor premiss is converted *simply* (*s*). The con-

clusion of the reduct is also converted *simply* (final s).

(iii) *Festino* to *Ferio* :—

$$\begin{array}{ccc}
 \text{No } P \text{ is } M & \text{---} & \text{No } M \text{ is } P \\
 \text{Some } S \text{ is } M & & \text{Some } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P & \therefore \text{Some } S \text{ is not } P
 \end{array}$$

(iv) *Baroco* as *Faksoko* to *Ferio* :—

$$\begin{array}{ccc}
 \text{All } P \text{ is } M & \text{---} & \text{No not-}M \text{ is } P \\
 \text{Some } S \text{ is not } M & & \text{Some } S \text{ is not } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P & \therefore \text{Some } S \text{ is not } P
 \end{array}$$

FIGURE 3.

(i) *Darapti* to *Darii* :—

$$\begin{array}{ccc}
 \text{All } M \text{ is } P & & \text{All } M \text{ is } P \\
 \text{All } M \text{ is } S & \text{---} & \text{Some } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is } P & & \therefore \text{Some } S \text{ is } P
 \end{array}$$

(ii) *Disamis* to *Darii* :—

$$\begin{array}{ccc}
 \text{Some } M \text{ is } P & & \text{All } M \text{ is } S \\
 \text{All } M \text{ is } S & \cancel{\text{---}} & \text{Some } P \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is } P & & \therefore \text{Some } P \text{ is } S \\
 & & \therefore \text{Some } S \text{ is } P
 \end{array}$$

(iii) *Datusi* to *Darii* :—

$$\begin{array}{ccc}
 \text{All } M \text{ is } P & & \text{All } M \text{ is } P \\
 \text{Some } S \text{ is } M & \cancel{\text{---}} & \text{Some } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is } P & & \therefore \text{Some } S \text{ is } P
 \end{array}$$

(iv) *Felapton* to *Ferio* :—

$$\begin{array}{ll}
 \text{No } M \text{ is } P & \text{No } M \text{ is } P \\
 \text{All } M \text{ is } S & \text{Some } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P & \therefore \text{Some } S \text{ is not } P
 \end{array}$$

(v) *Bocardo* as *Dokosmosk* to *Darii* :—

$$\begin{array}{ll}
 \text{Some } M \text{ is not } P & \text{All } M \text{ is } S \\
 \text{All } M \text{ is } S & \text{Some not-}P \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P & \therefore \text{Some not-}P \text{ is } S \\
 & \therefore \text{Some } S \text{ is not } P \\
 & \quad (\text{by conversion}) \\
 & \therefore \text{Some } S \text{ is not-}P \\
 & \quad (\text{by obversion})
 \end{array}$$

(vi) *Ferison* to *Ferio* :—

$$\begin{array}{ll}
 \text{No } M \text{ is } P & \text{No } M \text{ is } P \\
 \text{Some } S \text{ is } M & \text{Some } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P & \therefore \text{Some } S \text{ is not } P
 \end{array}$$

FIGURE 4.

(i) *Bramantip* to *Barbara* :—

$$\begin{array}{ll}
 \text{All } P \text{ is } M & \cancel{\text{All } M \text{ is } S} \\
 \text{All } M \text{ is } S & \cancel{\text{All } P \text{ is } M} \\
 \hline
 \therefore \text{Some } S \text{ is } P & \therefore \text{All } P \text{ is } S \\
 & \therefore \text{Some } S \text{ is } P
 \end{array}$$

(ii) *Camenes* to *Celarent* :—

$$\begin{array}{ll}
 \text{All } P \text{ is } M & \cancel{\text{No } M \text{ is } S} \\
 \text{No } M \text{ is } S & \cancel{\text{All } P \text{ is } M} \\
 \hline
 \therefore \text{No } S \text{ is } P & \therefore \text{No } P \text{ is } S \\
 & \therefore \text{No } S \text{ is } P
 \end{array}$$

(iii) *Dimaris* to *Darii* :—

$$\begin{array}{ccc}
 \text{Some } P \text{ is } M & \cancel{\text{All } M \text{ is } S} & \text{All } M \text{ is } S \\
 \text{All } M \text{ is } S & \cancel{\text{Some } P \text{ is } M} & \text{Some } P \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is } P & & \therefore \text{Some } P \text{ is } S \\
 \cdot & & \therefore \text{Some } S \text{ is } P
 \end{array}$$

(iv) *Fesapo* to *Ferio* :—

$$\begin{array}{ccc}
 \text{No } P \text{ is } M & \text{No } M \text{ is } P \\
 \text{All } M \text{ is } S & \text{Some } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P & \therefore \text{Some } S \text{ is not } P
 \end{array}$$

(v) *Fresison* to *Ferio* :—

$$\begin{array}{ccc}
 \text{No } P \text{ is } M & \text{No } M \text{ is } P \\
 \text{Some } M \text{ is } S & \text{Some } S \text{ is } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P & \therefore \text{Some } S \text{ is not } P
 \end{array}$$

5. **Examples of Indirect Reduction.**—In *Reductio per Impossible* we form a new syllogism which proves the formal truth of the original conclusion by pointing out the falsity of its contradictory. We have seen that the *direct* reduction of two moods, *Baroco* and *Bocardo* involved negative terms. If we do not want to use such terms we can reduce these two moods by the *indirect* process ; thus :—

(i) *Baroco* to *Barbara* :—

$$\begin{array}{c}
 \text{All } P \text{ is } M \\
 \text{Some } S \text{ is not } M \\
 \hline
 \therefore \text{Some } S \text{ is not } P
 \end{array}$$

This conclusion must be true. For, if not, suppose it is false ; then its contradictory, i.e., *SaP* must be true. Therefore, replacing the minor premiss (which is

followed by *c* in *Baroco*) by SaP, we get the following syllogism in *Barbara*, with *P* for its middle term :—

<i>Baroco.</i>	<i>Barbara.</i>
All <i>P</i> is <i>M</i>	All <i>P</i> is <i>M</i>
<u>Some <i>S</i> is not <i>M</i></u>	<u>All <i>S</i> is <i>P</i></u>
\therefore Some <i>S</i> is not <i>P</i>	\therefore All <i>S</i> is <i>M</i>

Thus, if 'All *S* is *P*' is true, 'All *S* is *M*' is also true. But in that case the original premiss 'Some *S* is not *M*' cannot be true. Hence 'All *S* is *P*' must be false; consequently, the original conclusion 'Some *S* is not *P*' must be true. Thus the mood *Baroco* is valid.

(ii) *Bocardo* to *Barbara* :—

Some <i>M</i> is not <i>P</i>
<u>All <i>M</i> is <i>S</i></u>
\therefore Some <i>S</i> is not <i>P</i>

Now, this conclusion, SoP, must be true. For if it be false, its contradictory, SaP, must be true. Substituting this proposition for the major premiss, we get the following syllogism in *Barbara*, with *S* for its middle term :—

<i>Bocardo.</i>	<i>Barbara.</i>
MoP	SaP
<u>MaS</u>	<u>MaS</u>
\therefore SoP	\therefore MaP

But MaP must be false, since it contradicts the original major premiss MoP. Hence SaP must be false which implies that SoP, the original conclusion, must be true. Hence the mood *Bocardo* is valid.

Thus we see that in *Baroco* the contradictory of the conclusion is combined with the major premiss to prove the falsity of the minor ; while in *Bocardo* the contradictory of the conclusion is combined with the minor premiss to prove the falsity of the major. The initial B in either case indicates a syllogism in *Barbara* as the means of Indirect Reduction.

6. Scope of the Two Methods.—We have shown how every mood could be reduced *directly*. It remains to add that although the *indirect* method (*Reductio ad absurdum*) is usually employed for *Baroco* and *Bocardo* only, it may as well be applied to *all* syllogisms ; for if we substitute for any given premiss the contradictory of the conclusion, we obtain for a new conclusion the contradictory of the Premiss.* For instance, let us reduce *Bramantip* indirectly :—

$$\begin{array}{c} \text{P} \text{a} \text{M} \\ \text{M} \text{a} \text{S} \\ \hline \therefore \text{S} \text{e} \text{P} \end{array}$$

*J. Can. Acad. : R.
1st year class
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This conclusion must be true. For, if it were false, its contradictory *S e P* must be true. Combining it

* Or, its contrary, which obviously includes the contradictory. "The new conclusion will not always contradict an original premiss, but sometimes a proposition, the truth of which is deducible from an original premiss ; such as the *particular* contained under it, or its simple or *accidental* converse ; which will be equally efficacious towards proving that the original conclusion cannot be *false*" (J. Huyshe, *Treatise on Logic*, Oxford, 2nd ed. p. 117 note).

with the minor premiss we have *Celarent*, with S as the middle term :

$$\begin{array}{c}
 S \epsilon P \\
 M a S \\
 \hline
 \therefore M e P \\
 \therefore P e M \text{ (by conversion).}
 \end{array}$$

But the new conclusion PeM is the contrary of PaM, the original major premiss, and they cannot both be true. Hence PeM is false ; consequently the original conclusion SiP must be true.

Now, it may be pointed out that the two methods are not *reduction* in the same sense. In its technical sense, Reduction can only mean the Direct Process (Ostensive), while it is only by a play upon the word Reduction that it can be called indirect.* In the “*direct*” process the new syllogism is the same argument as the old ; in the “*indirect*” it is not the same. Again, following Aristotle, one might call the whole of the “*indirect*” process as “*Reductio per impossibile*,” and that portion of it in which a new syllogism is drawn, “*Reductio ad impossibile*.” The whole method may, with propriety, be called “*Demonstratio per impossibile*” rather than “*Reductio per impossibile*.” Euclid frequently makes use of this method ; and it was also popular with the scholastics, because of their dislike of negative terms which must occur in obversion and contraposition, without which the direct reduction of Baroco and Bocardo was impossible. The method “dates

* See Karlslake, *Study of Logic* (Oxford, 1851) Book I. p. 84.

from time before the processes of obversion and contraposition were recognised,"* and is not to be discarded as entirely useless. It is one of the easiest tests of the validity of any syllogism.

The process of Reduction also applies to **Pure Hypothetical Syllogisms**, since conversion and other reductions are valid in their case also.

7. Is Reduction necessary?—Syllogistic theory is mainly concerned with the distinction of valid and invalid arguments. Aristotle and his followers stated only *one* general principle, the *Dictum de omni et nullo* as the basis of the syllogism, and by reference to which the validity of an argument was to be determined. But as the *Dictum* directly applied to the First Figure only, Aristotle laid down the process of Reduction by which all arguments could be transformed into their equivalents in Fig. I and could thus be tested by the *Dictum*. Hence from the Aristotelian standpoint Reduction is a very essential and important part of the syllogistic doctrine. Thus Whately observes: "As it is on the *Dictum de omni et nullo* that all Reasoning ultimately depends, so, all arguments may be in one way or other brought into some one of the four moods in the First Figure: and a Syllogism is, in that case, said to be *reduced*."[†] The superiority of the First Figure is the basis of Reduction.

But those, who do not follow Aristotle in taking the First Figure as the only "Perfect" Figure, and who,

* A Sidgwick, *op. cit.* p. 43.

† Whately, *Elements of Logic*, p. 93.

instead of holding that the *Dictum de omni et nullo* is the only principle for all perfect inference, make out that each figure is independent of the others and is based on its own specific *Dictum*, consider Reduction to be at once *unnecessary* and *unnatural*. Each figure is a distinct type by itself, and an argument which naturally falls into one figure does not necessarily and obviously fall into another. Each figure has its independent validity,* and consequently Reduction may be banished from Logic.

But with this view we are not disposed to have much sympathy. Science always aims at reducing its data to a single general principle, and at putting in coherence, system and order in the otherwise scattered details of knowledge. It is certainly more creditable to be able to show a fundamental unity in all the moods and figures than to frame independent and sometimes awkward laws for each figure separately. Why introduce in Logic all these separate *dicta* as further encumbrances, when only one *dictum* can serve the purpose in view? Reduction shows the intrinsic unity of the syllogism, and besides, it is an extremely useful mental exercise.† It does not question the fact that the most natural form of an argument is in the figure to which

* "The 'imperfect' figures are misrepresented by reduction to the first.....It must always be remembered that the character of an argument is determined not by the form into which it is thrown in words, but by that which it assumes in our thought. This is our justification for recognising the figures as distinct types"—Joseph, *op. cit.* p. 306.

† On this point read Keynes, *op. cit.* p. 191; Coffey, *op. cit.* p. 336; Carveth Read, *op. cit.* p. 130.

it belongs, but it only shows that behind all specific differences of figure there exists an essential unity. Reduction is an admirable instrument for testing the validity of any mood by reference to its fundamental *Dictum*. We are, therefore, of opinion that Reduction is a necessary part of a scientific or complete theory of the Syllogism.

8. **Some useful Tables.**—We may here append a few tables which will prove useful to the student in summing up the doctrine of Reduction.

The distinction of figure rests on the position of terms. Transformation of one figure into another means, therefore, the alteration of this position—which is only possible by *conversion*. But as O propositions cannot be converted, this process fails in its application to all moods. The following table is arranged after Solly* and gives those conditions which must be answered by any syllogism in each figure for its transformation into any other; but in order to know if a syllogism is capable of answering these conditions, it will be necessary to examine its particular mood:—

Figure to be transformed	PROPOSITIONS TO BE CONVERTED FOR TRANSFORMATION INTO			
	Fig. 1	Fig. 2	Fig. 3.	Fig. 4.
Fig. 1		Major	Minor	Conclusion or Major and Minor.
Fig. 2	Major		Major and minor.	Minor or Major and conclusion.
Fig. 3	Minor	Major and minor.		Major
Fig. 4	Conclusion or Major and Minor.	Minor	Major	

* Cf. Solly, *Syllabus of Logic*, Cambridge, 1839, p. 94.

We have already seen that in *Indirect Reduction* the new syllogism may be a combination of the contradictory of the original conclusion with either the major or the minor premiss. The following table shows the forms assumed by the syllogism in either case :—

Figure to be transformed indirectly.	Major Premiss and Contradictory of conclusion being Premisses.	Minor Premises and Contradictory of conclusion being Premisses.
Fig. 1. $\begin{array}{c} M-P \\ S-M \\ \hline S-P \end{array} \quad \left. \begin{array}{c} M-P \\ S-M \\ \hline S-P \end{array} \right\} \text{becomes} \quad \left. \begin{array}{c} M-P \\ S-P \\ \hline S-M \end{array} \right\}$	Fig. 2 $\begin{array}{c} M-P \\ S-P \\ \hline S-M \end{array}$	Fig. 3 $\begin{array}{c} S-P \\ S-M \\ \hline M-P \end{array}$
Fig. 2 $\begin{array}{c} P-M \\ S-M \\ \hline S-P \end{array} \quad \left. \begin{array}{c} P-M \\ S-P \\ \hline S-M \end{array} \right\} \text{becomes} \quad \left. \begin{array}{c} P-M \\ S-P \\ \hline S-M \end{array} \right\}$	Fig. 1 $\begin{array}{c} P-M \\ S-P \\ \hline S-M \end{array}$	Fig. 3 $\begin{array}{c} S-M \\ S-P \\ \hline P-M \end{array}$
Fig. 3 $\begin{array}{c} M-P \\ M-S \\ \hline S-P \end{array} \quad \left. \begin{array}{c} S-P \\ M-P \\ \hline M-S \end{array} \right\} \text{becomes} \quad \left. \begin{array}{c} S-P \\ M-P \\ \hline M-S \end{array} \right\}$	Fig. 2 $\begin{array}{c} S-P \\ M-P \\ \hline M-S \end{array}$	Fig. 1 $\begin{array}{c} S-P \\ M-S \\ \hline M-P \end{array}$
Fig. 4 $\begin{array}{c} P-M \\ M-S \\ \hline S-P \end{array} \quad \left. \begin{array}{c} S-P \\ P-M \\ \hline M-S \end{array} \right\} \text{becomes} \quad \left. \begin{array}{c} S-P \\ P-M \\ \hline M-S \end{array} \right\}$	Fig. 4 $\begin{array}{c} S-P \\ P-M \\ \hline M-S \end{array}$	Fig. 4 $\begin{array}{c} M-S \\ S-P \\ \hline P-M \end{array}$

The following table* states certain deductions obvious from the above table, viz., for each valid mood in Fig. 1 there must be an equivalent mood in Fig. 2 and Fig. 3, and the same is true of each valid mood of Fig. 2 and Fig. 3. Hence the number of valid moods in each of the first three figures must be the same. The Fourth figure

* This and the preceding Table were drawn up by Thomas Solly. Cf. *Syllabus of Logic*, pp. 109—111.

is peculiar in this respect. It only admits of an indirect proof by syllogisms in the same figure. Thus we have the following sets of equivalent trios :—

FIG. 1, 2, 3.

FIGURE.	6 VALID MOODS WITH CORRESPONDING MOODS IN THE OTHER TWO FIGURES.					
First ...	AAA	AAI	AII	EA E	EA O	EIO
Second ...	AOO	AEO	AEE	EIO	EA O	EA E
Third ...	OAO	EA O	EIO	IAI	AAI	AII

FIGURE 4.

AAI	IAI
AEO	AEE
EA O	EIO

The following table indicates the moods of the First Figure to which those of the Second, Third and Fourth Figures are reducible by *Deductio ad impossibile* (Indirect Method) :—

Indirect Reduction.

FIG. 2 REDUOEND.	FIG. 1 REDUCT.	FIG. 3 REDUOEND.	FIG. 1 REDUCT.	FIG. 4 REDUOEND.	FIG. 1 REDUCT
Cesare	Ferio	Darapti	Celarent	Bramantip	Celarent
Camestres	Darii	Disamis	Do.	Camenes	Darii
Fest no	Celarent	Datisi	Ferio	Dimaris	Celarent
Baroco	Barbara	Felapton	Barbara	Fesapo	Barbara or Celarent
		Bocardo	Barbara	Fresison	Darii or Celarent
		Ferison	Darii		

9. **Typical Examples Worked Out.**—The following typical examples are likely to prove helpful to the student:—

(1) Name the Mood and Figure of the following arguments and reduce them to the First Figure:—

(i) Some musicians are mad ;
All musicians are men ;
∴ Some men are mad.

This is *Disamis*, Fig. 3, and is reduced to *Darii*.

All musicians are men ;
Some mad persons are musicians ;
∴ Some mad persons are men.

(ii) No Buddhists are Christians ;
All Buddhists are vegetarians ;
∴ Some vegetarians are not Christians.

This is *Felapton*, Fig. 3, and becomes *Ferio* :

No Buddhists are Christians ;
Some vegetarians are Buddhists ;
∴ Some vegetarians are not Christians.

(iii) All Bengalis are Indians ;
No Indians are Negroes ;
∴ No Negroes are Bengalis.

This is *Camenes*, Fig. 4, and becomes *Celarent* :

No Indians are Negroes ;
All Bengalis are Indians ;
∴ No Bengalis are Negroes.
∴ No Negroes are Bengalis (by conversion).

(iv) No wise men are quarrelsome ;
 Some shopkeepers are quarrelsome ;
 ∴ Some shopkeepers are not wise men.

This is *Festino*, Fig. 2, and becomes *Ferio* :

No quarrelsome persons are wise men ;
 Some shopkeepers are quarrelsome persons ;
 ∴ Some shopkeepers are not wise men.

(2) Show how the Subaltern Moods in the 'imperfect' figures can be reduced.

These are three : *Cesaro*, *Camestros* and *Camenos*. Their reduction is not provided for in the mnemonic lines. The following are the schemes of their reduction :

(i) *Cesaro* becomes *Celarent* :

$$\begin{array}{ccc} P e M & & M e P \\ \underline{S a M} & & \underline{S a M} \\ \therefore S o P & & \therefore S o P \end{array}$$

(ii) *Camestros* becomes *Celarent* :

$$\begin{array}{ccc} P a M & & M e S \\ \underline{S e M} & & \underline{P a M} \\ \therefore S o P & & \therefore P e S \\ & & \therefore S e P \text{ (conversion)} \\ & & \therefore S o P \text{ (subalternation)} \end{array}$$

(iii) *Camenos* becomes *Celarent* :

$$\begin{array}{ccc} P a M & & M e S \\ \underline{M e S} & & \underline{P a M} \\ \therefore S o P & & \therefore P e S \\ & & \therefore S o P \text{ (conversion per} \\ & & \text{accidens)} \end{array}$$

Thus, for purposes of reduction, Camestros and Camenos may be named *Camestrop* and *Camenop* respectively (the final *p* denoting 'conversion *per accidens*' of the preceding O).

(3) Construct a syllogism in *Baroco* to prove that 'Some rulers are not just' and reduce it to the first figure.

The syllogism in *Baroco* is—

All just persons are universally respected ;
Some rulers are not universally respected ;
∴ Some rulers are not just.

(a) *Baroco* is to be named *Faksoko* for *Direct Reduction*.

This becomes *Ferio* :

No not-universally-respected-persons are just ;
Some rulers are not-universally-respected-
persons ;
∴ Some rulers are not just.

b) *Indirect Reduction of Baroco* :

If the conclusion is false, its contradictory must
be true ;

∴ All rulers are just.

Combining it with the original major premiss, we get
in *Barbara*—

All just persons are universally respected ;
All rulers are just ;
∴ All rulers are universally respected.

But this conclusion is the contradictory of the original minor premiss, and must therefore be false. Hence the original conclusion must be true. Thus the argument is valid.

(4) Construct a syllogism in *Ferison* to prove that 'Some students are not intelligent' and reduce it to the First Figure.

Ferison.

No athletes are intelligent ;
Some athletes are students ;
∴ Some students are not intelligent.

This is reduced to *Ferio* :

No athletes are intelligent ;
Some students are athletes ;
∴ Some students are not intelligent.

(5) Construct a syllogism in *Dimaris* to prove that 'Some Indians are Christians' and reduce it to the First Figure.

Dimaris.

Some Christians are natives of Madras,
All natives of Madras are Indians,
∴ Some Indians are Christians.

This is reduced to *Darii* :

All natives of Madras are Indians ;
Some Christians are natives of Madras ;
∴ Some Christians are Indians.
∴ Some Indians are Christians.

(6) Construct a syllogism in *Darapti* to prove that 'Some dreamers are wise' and reduce it to the First Figure.

Darapti.

All philosophers are wise ;
 All philosophers are dreamers ;
 ∴ Some dreamers are wise.

This becomes *Darii* :

All philosophers are wise ;
 Some dreamers are philosophers ;
 ∴ Some dreamers are wise.

SUMMARY.

Reduction of an argument is the process of expressing it in some other Figure or Mood. In its technical sense, however, Reduction means the transformation of a mood of some other figure to a mood of the first figure. This process is a very important element of the doctrine of syllogism, according to Aristotle and his followers, who maintained the superiority of the first figure over the others and based all syllogistic reasoning on one axiom, viz.. the *dictum de omni et nullo*.

There are two types of Reduction :—

(i) **Direct or Ostensive Reduction** :—When the original conclusion is deduced from premisses derived from those given. The change of the mood is effected by conversion, obversion and the transposition of premisses. This process is applicable to all moods except *Baroco* and *Bocardo*, to which it can be applied through contraposition, which necessitates the use of negative terms.

(ii) **Indirect Reduction or Reductio per impossible** :—When we establish, by means of a new syllogism in the first figure (in which the contradictory of the original conclusion appears as a premiss), the validity of the original conclusion, by proving the falsity of its contradictory. This process is usually applied to *Baroco* and *Bocardo*, but, like Direct Reduction, its application could also be extended to *all* moods. This process is also known as *Reductio ad absurdum*, and is frequently employed by Euclid.

Although some logicians have proposed separate *dicta* for each figure, yet if the science of Logic is to achieve the purpose of unifying its details, we must look upon Reduction as a necessary part of the theory of the syllogism. Reduction brings out the systematic unity of such theory, and is, in addition, a most useful exercise for mental development.

CHAPTER VII.

UNORTHODOX SYLLOGISMS.

1. **Limits of Traditional Syllogism.**—We said above that the principal type of Mediate Inference was the Syllogism. We implied thereby the existence of certain **non-syllogistic forms**, which may, therefore, be called *unorthodox*. Now, there are two principal views to be considered. Some logicians hold that the Syllogism is the only form of mediate inference and that there is no such thing as non-syllogistic arguments. Any valid argument can be so manipulated as to appear in the syllogistic form. For instance, according to Whately, the Syllogism is the form to which all correct reasoning may ultimately be reduced. Mill* also speaks of the possibility of exhibiting all valid ratiocination in some form of the traditional syllogism. On the other hand, some logicians maintain that the syllogism is not the exclusive type of all mediate inference, that a separate scheme should be drawn up for the construction and consideration of certain non-syllogistic forms, and that the validity of such forms should be tested by means of a separate axiom, other than the *Dictum de omni et nullo*.† The syllogism is confined to terms related as Subject and Predicate, but terms may be mutually related in other ways as well.

* Mill, *System of Logic*, Bk. II. Ch. ii.

† “The claims that have been put forward on behalf of the syllogism as the exclusive form of all deductive reasoning must accordingly be rejected” (Keynes).

2. The argumentum a fortiori.—Let us take an instance of the unorthodox syllogism;

A is greater than B,
B is greater than C,
∴ A is greater than C.

This is known as the '*a fortiori* syllogism,' and it is not possible to transform it into an orthodox syllogism.* If, therefore, it cannot conform to the *dictum de omni et nullo*, it should be subsumed under a new *dictum*, which may be expressed as—"Whatever is greater than a second thing which is greater than a third thing is itself greater than the third thing."

But the defenders of the Traditional Syllogism will say that even arguments of this type can easily be turned into the syllogistic form; thus:—

(A thing which is greater than a second thing
which is greater than a third thing) is (greater
than the third thing);

(This thing A) is (greater than a second thing B,
which is greater than a third thing C);

∴ (This thing A) is (greater than the third thing C).

Now, we might observe that it may go in favour of Logic as a science to be able to reduce all arguments to the syllogistic form, but the truth is that such

* Miss Constance Jones calls the *orthodox* or *traditional*, syllogism as "absolute" and the *unorthodox* as "relative" argument. On this subject refer to her *Introduction to General Logic* (Longmans, 1892) pp. 129—132. Also cf. Boyce Gibson *op. cit.* p. 250; read Coffey, *op. cit.* I. pp. 388—92.

reduction possesses no utility. The form to which the argument *a fortiori* is reduced is so clumsy and unnatural that we must have recourse to some other way of testing its validity. What we have actually done is to transform a four-termed argument into a three-termed one. Dr. Keynes rightly says that so long as we retain the orthodox copula-mark, many types of argument are irreducibly four-termed.

The simplest way out of the difficulty is to recognise the fact that in such arguments the terms are not related in the subject-predicate relation but differently, and thus we may substitute "is greater than" for "is" as copula in this argument :

- (A) *is greater than* (B) ;
- (B) *is greater than* (C) ;
- ∴ (A) *is greater than* (C).

3. Logic of Relatives.—The consideration of such arguments is developed in what is known as the *Logic of Relatives* or the *Calculus of Relations* (which is connected with Symbolic Logic). The function of such Logic is to discuss *relation* in general, not merely the subject-predicate relation denoted by the copula "is." Dr. Venn defines Relation as "a mode of thinking of two objects together; a connection or want of connection."[†] The extreme vagueness and generality of this conception is a serious difficulty for the Logic of Relatives.

4. Examples of Non-syllogistic Arguments.—We shall now set down a few examples of the *unorthodox*

[†] *Symbolic Logic*, p. 400.

*syllogism.** Dr. Keynes observes that "there are an indefinite number of other arguments which for similar reasons cannot be reduced to syllogistic form."† The typical examples are:—

(1) A is equal to B ; B is equal to C ;
 \therefore A is equal to C.

(2) A is north of B ; B is north of C ;
 \therefore A is north of C.

(3) A is to the left of B ; B is to the left of C ;
 \therefore A is to the left of C.

(4) A is brother to B ; B is brother to C ;
 \therefore A is brother to C.

(5) A is a contemporary of B ;
 B is a contemporary of C ;
 \therefore A is a contemporary of C.

(6) A is as clever as B ; B is as clever as C ;
 \therefore A is as clever as C.

(7) A is to the north of B ; B is to the east of C ;
 \therefore A is to the north-east of C.

(8) A is taller than B ; B is taller than C ;
 \therefore A is taller than C.

Copular relations ‡ include those of equality, brotherhood ; inclusion, exclusion, causation, sequence, magnitude, difference, and so on.

* This is also called "Comparative Syllogism." See Wilson, *Logic* (New York, 1856), p. 151.

† *Studies and Exercises in Formal Logic*, part iii., Ch. vii.

‡ Bradley's list of Relations includes Syntheses of (a) Subject and Attribute (orthodox syllogism), (b) Identity or Degree or Time and Space (unorthodox syllogism)—cf. Bradley, *op. cit.* pp. 243—4, also Welton, (i) p. 410.

5. Are they formally valid?—The unorthodox syllogisms cannot be *formally valid* but require some knowledge of the *relation* expressed by their copula. “They really rely on such empirical relations as the order of things in space and time, and the facts of human relationship. These relations are very familiar, and so the inferences are quite easy and evident.”* But their validity depends on *material* knowledge, and not simply on the *form* of the argument. If they had *formal* validity, then arguments like the following should also be valid, but they are not so:—

- (1) A is a friend of B ; B is a friend of C ;
 \therefore A is a friend of C.
- (2) A is father of B ; B is father of C ;
 \therefore A is father of C.
- (3) A was contemporary with B ; B with C ;
 \therefore A with C.
- (4) A touches B ; B touches C ;
 \therefore A touches C.

These inferences are obviously faulty. But with the aid of *material* knowledge we could, for instance, infer in (2) that ‘A is *grandfather* of C.’

Looked at from the *formal* standpoint, the non-syllogistic arguments contain four *terms*, and that is why they are so called. A syllogism cannot have more than *three* terms, but these arguments have *two* middle terms and *two* extremes, making altogether *four* terms.

* Schiller, *op. cit.* p. 213.

6. **Hamilton's Unfigured Syllogism.**—Hamilton distinguishes between a *figured* and *unfigured* syllogism. The latter results from a rigid quantification of the predicate, which allows an interchange of the subject and the predicate at pleasure; e.g., (1) "The preacher yesterday was Dr. A;" This gentleman is yesterday's preacher; ∴ This is Dr. A (2) $A=B$, $B=C$, ∴ $A=C$.*

The following is its axiom as stated by Hamilton:—

"In as far as two notions either both agree, or one agreeing the other does not, with a common third notion, in so far these notions do or do not agree with each other."

The *figured* syllogism is already known to us as an argument in which the terms are related as subject and predicate in propositions.

SUMMARY.

Besides the Traditional Syllogism there are several forms which cannot be so reduced, and which are therefore called 'unorthodox' syllogisms or non-syllogistic arguments.

These arguments are not *formally* valid but depend on *material* knowledge. They have *four terms* if viewed from the formal standpoint, which recognises only the orthodox form of the copula.

But with a recognition of copular *relations*, they are reduced to a three-termed argument, and are based on

* Cf. Croke, *op. cit.* p. 152.

their own axiom. The *Logic of Relatives* is still very vague and incomplete.

Those logicians who quantify the predicate escape the complexity of figure, since they make every proposition a statement of equality or inequality. This makes all categorical syllogism of one and the same type—hence called **Unfigured Syllogism**. Such arguments are frequently employed in mathematics.

CHAPTER VIII.

ABRIDGED AND CONJOINED SYLLOGISMS.

1. **Enthymeme.**—The Enthymeme is a syllogism with a suppressed premiss or conclusion.* It is an abridged syllogism; and it is in this form that we actually argue. It is a natural mode of reasoning.† We do not want to say more than what is required for a clear expression of our thought, and it would be pedantry to express our arguments in complete syllogisms. We usually omit that element of our argument which is so obvious that others can be expected to supply it in following our discourse. The enthymeme is, however, not an immediate inference, since its premiss may be omitted; but this form of expression does not affect the form of thought, and it does not infer from a single proposition. There are three kinds of Enthymemes:—

First Order.—in which the major premiss is omitted; e.g., 'William can be won over, for

* This is not the sense in which the term was defined by Aristotle. He defined the Enthymeme as a *syllogism drawn from probabilities, and signs of the conclusion*. Father Clarke says: "It differs from the syllogism proper in its matter; the form may be the same, though it is not always so"—Clarke, *Logic* (Longmans, 1895), p. 356. Aristotle's definition is now restricted to Rhetorical Enthymeme. The current definition originated in a false etymology.

† "The argument first occurs to our mind in the form of an *enthymeme*, but when we wish to make it clearer, we extend it to a *syllogism*"—Gilbart, *Logic for the Million* (quoted by Boyce Gibson, p. 231.)

he is not resolute'; or, 'Paul will be successful for he is industrious.'

Second Order.—in which the minor premiss is omitted; *e.g.*, 'William can be won over, for all who are not resolute can be won over'; or, 'Paul will be successful, because all industrious persons are successful.'

Third Order.—in which the conclusion is suppressed; *e.g.*, 'All who are not resolute can be won over, and William is not resolute'; 'All industrious persons are successful, and Paul is industrious.'

2. Figure and Mood of Enthymemes.—This can be easily determined in the following manner:—If an enthymeme belongs to the first or the second order, the suppressed premiss can easily be discovered. If the given propositions have the same subject, the argument is in Fig. 1 or 2; if they have the same predicate, it is in Fig. 1 or 3. Again, if the subject of the conclusion is the predicate of the given premiss, it is in Fig. 3 or 4; and if the predicate of the conclusion is the subject of the given premiss, the argument is in Fig. 2 or 4. In an enthymeme of the third order the position of the middle term can at once determine the figure of the argument.

3. Prosyllogism and Episyllogism.—A chain of arguments (which may be of any length) in which the conclusion of one syllogism becomes a premiss in another

is called a **Polysyllogism**. If we select in it any pair of syllogisms, we see that the conclusion of one of them is used as a premiss of another. The former is known as a **Prosylllogism**, and the latter an **Episylllogism**. For instance—

All A's are B's	.	.	.	.	(1)
All C's are A's	.	.	.	.	(2)
∴ All C's are B's	.	.	.	.	(3)
But All D's are C's	.	.	.	.	(4)
∴ All D's are B's	.	.	.	.	(5)

Here we have a *Polysyllogism* composed of two syllogisms. The first syllogism is the *Prosylllogism*, composed of (1), (2) and (3), and its conclusion (3) forms the major premiss of the second syllogism, composed of (3), (4) and (5), the *Episylllogism*.

4. **Epicheirema**.—The Epicheirema is a syllogism in which either one or both premisses are supported by a reason. It is a conjoined and abridged syllogism. The reason attached to one or both premisses shows the existence of a prosyllogism not fully expressed. The prosyllogism appears in it as an *enthymeme*; the episylllogism is completely expressed.

The Epicheirema may also be called “a chain of reasoning of an abridged and concentrated kind” (B. Gibson). When a reason is given for one of the premisses, it is a **Single Epicheirema**; e.g., ‘All M's are P's, because they are X's; All S's are M's; ∴ All S's are P's.’ When a reason is

attached to both the premisses, it is a **Double Epicheirema**; e.g.—

All M's are P's, because they are X's;
 All S's are M's, because they are Y's;
 ∴ All S's are P's.

All Hindus are content with their lot, because they have faith in **Karma**;
 All Rajputs are Hindus, because they have faith in the **Vedas**;
 ∴ All Rajputs are content with their lot.

5. **Sorites**.—The **Sorites** is 'a polysyllogism with the intermediate conclusions suppressed'*. It is a series of syllogisms, in which the conclusion of each, except the last, becomes a premiss in the following. It is a *progressive polysyllogism*, as it proceeds from prosyllogism to episyllogism. Mr. Stock speaks of it as "the neatest and most compendious form that can be assumed by a train of reasoning."† Two forms of **Sorites** are recognised; (i) the **Progressive** or the so-called **Aristotelian**,‡ and (ii) the **Regressive** or the **Goclenian**§. The former is the more usual form. In it the omitted conclusions are placed as the minor premisses of the

* Or, "A syllogism in the first figure with many middle terms"—Joseph, *op. cit.* p. 326. The word *sorites* means 'a heap.'

† Stock, *op. cit.* p. 352. Also note that the form of the premisses which appears in a *sorites* is either of Fig. 1 or Fig. 4 premisses. The common or *regular* *sorites* is in Fig. 1. The *irregular* *sorites* may be in different figures.

‡ Because they were not actually treated of by Aristotle.

§ This form was discovered first by Rodolphus Goclenius. Professor at Marburg, who flourished at the end of the 16th century.

following syllogisms, while in the Regressive form they appear as the major.

<i>Progressive or</i> <i>"Aristotelian" Sorites.</i>	<i>Regressive or</i> <i>Goclenian Sorites.</i>
All A is B.	All E is F.
All B is C.	All D is E.
All C is D.	All C is D.
All D is E.	All B is C.
All E is F.	All A is B.
∴ All A is F.	∴ All A is F.

In both these forms the propositions are the same ; only the order is reversed in the Regressive. But a sorites does not consist of a mere series of propositions. Its analysis shows that it is composed of syllogisms, one less in number than its premisses :—

<i>Progressive.</i>	<i>Regressive.</i>
(1) All B is C. All A is B. ∴ All A is C.	(1) All E is F. All D is E. ∴ All D is F.
(2) All C is D. All A is C. ∴ All A is D.	(2) All D is F. All C is D. ∴ All C is F.
(3) All D is E. All A is D. ∴ All A is E.	(3) All C is F. All B is C. ∴ All B is F.
(4) All E is F. All A is E. ∴ All A is F	(4) All B is F. All A is B. ∴ All A is F.

The following is a concrete example of a *Progressive Sorites* :—

All Lahore men are Punjabis ;
 All Punjabis are Indians ;
 All Indians are Asiatics ;
 ∴ All Lahore men are Asiatics.

If the order of these propositions is reversed, we have a *Regressive Sorites*.

6. Special Rules of the Aristotelian Sorites.—They are two in number :—

RULE 1.—*Only the first premiss can be particular.*
 If any premiss other than the first were particular, it will give us a particular major premiss in Fig. 1, which may result in Illicit Process of the Major or Undistributed Middle.

RULE 2.—*Only the last premiss can be negative.*
 For if any other premiss were negative, it will give us a negative conclusion, which will be inadmissible as a minor premiss in the following syllogism, as it involves Illicit Process of the Major.

7. Special Rules of the Goclenian Sorites.—They may be stated as follows :—

RULE 1.—*Only the last premiss can be particular,* otherwise the fallacy of Undistributed Middle arises.

RULE 2.—*Only the first premiss can be negative* otherwise a syllogism will arise with *two negative premisses*.

8. **Figure of Sorites.**—While a Syllogism has only *one* middle term, a Sorites has *many* middle terms. It cannot be framed in the second and third figures,* although some logicians (*e.g.*, Hamilton) maintain such possibility.

9. Typical Examples.—

(1) Supply the missing elements in the following enthymemes :—

(i) John must be dyspeptic, for he resides in Calcutta.

Here the complete syllogism in *Barbara* is :

All who reside in Calcutta are dyspeptic ;

John resides in Calcutta ;

∴ John is dyspeptic.

(ii) All graduates are well-behaved, and Sorabji is a graduate.

The syllogism is :—

All graduates are well-behaved ;

Sorabji is a graduate ;

∴ Sorabji is well-behaved.

* Except by the conversion of *particular* and *negative* propositions. See Welton i. p. 398, B. Gibson, p. 259.

(2) Construct a valid sorites with a negative premiss, and another with a particular premiss.

(i) All negroes are men ;

 All men are rational ;

 All rational beings can be civilised ;

 None who can be civilised should be killed ;

∴ No negroes should be killed.

(ii) Some scholars are Bengalis ;

 All Bengalis are Indians ;

 All Indians are of a philosophic temper ;

∴ Some scholars are of a philosophic temper.

SUMMARY.

An **Enthymeme** is a syllogism with a suppressed premiss or conclusion. It is of the First, Second or Third Order according as the major premiss or the minor premiss or the conclusion is omitted.

A **Polysyllogism** is a chain of arguments in which the conclusion of one becomes a premiss in another. The former is called a **Prosyllogism**, and the latter an **Episyllogism**.

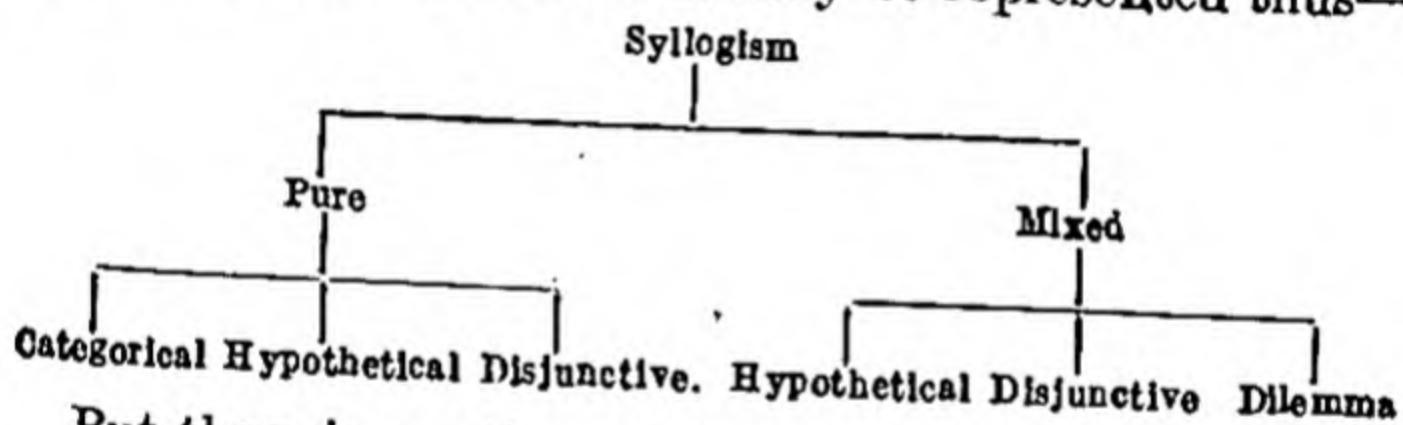
An **Epicheirema** is a syllogism with reasons given for one or both of the premisses.

A **Sorites** is a chain of syllogisms with the intermediate conclusions omitted. It is a syllogism with many middle terms. It may be of any length. It has two forms (1) **Progressive** or **Aristotelian** (2) **Regressive** or **Goclenian**.

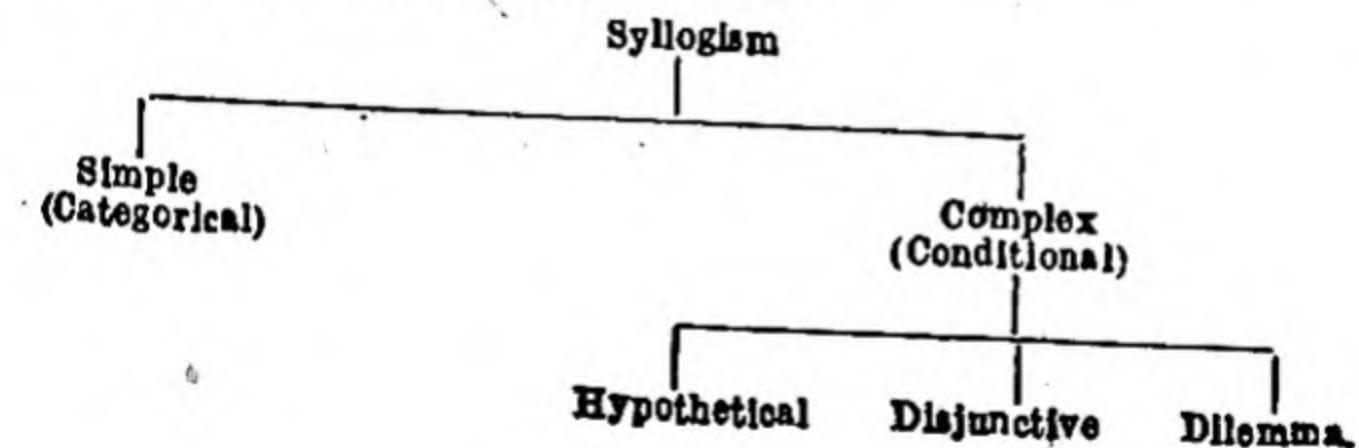
CHAPTER IX.

MIXED SYLLOGISMS.

1. **Pure and Mixed Syllogisms.**—We have classified syllogisms on the basis of those kinds of propositions which enter into them, *viz.*, the categorical, the hypothetical and the disjunctive. If both the premisses of a syllogism are of the same kind, we have a **Pure Syllogism**; if of different kinds, we have a **Mixed Syllogism**. Each of these has three forms. The former is sub-divided into Pure Categorical, Pure Hypothetical and Pure Disjunctive. So far we have been dealing principally with the Pure Categorical, and secondarily with the other two forms as well. Now we pass on to a discussion of the three kinds of Mixed Syllogism, *viz.* Mixed Hypothetical, Mixed Disjunctive and Dilemma. This scheme may be represented thus—



But there is another scheme also, according to which we deal with conditional arguments all at once, instead of treating of them separately as *pure* and *mixed*. This may be represented as follows :—



We shall, however, stick to the scheme we have already adopted, and shall now proceed to consider the *mixed* forms of the syllogism. But before doing so, we might as well recapitulate the distinction between Categorical and Hypothetical propositions. The former assert the existence of individual things and their subject-predicate relation, while the latter go beyond individual cases and express "a general law of the connection of attributes or qualities which shall be true universally."* "Hypothetical reasoning," says Mr. Joseph,† "rests upon another relation than that of subject and predicate—the relation of logical dependence; and there is not necessarily any middle term." As the syllogism cannot exist without a middle term, Mr. Joseph warns us against the error of identifying *hypothetical reasoning* with *syllogism*. Aristotle recognised only the Categorical syllogism; the Hypothetical and the Disjunctive were discovered later on by the peripatetics Eudemus and Theophrast. But it is only one form of the hypothetical syllogism, *viz.*, 'If A is B, C is D,' and not the other, *viz.*, 'If A is B, it is C' that offers some difficulty in reduction to the categorical form.‡

2. Mixed Hypothetical Syllogism.—The Mixed Hypothetical Syllogism has a hypothetical major premiss; a categorical minor premiss, which either

* J. E. Creighton, *Introductory Logic* (Macmillan, 1909), p. 151.

† *op. cit.* p. 312.

‡ See *supra*, Book II, Ch. III.

affirms the antecedent or denies the consequent of the major; and a categorical conclusion.*

The Mixed Hypothetical Syllogism has two forms: (1) the **Modus Ponens**, or the mood that posits the antecedent, which is **Constructive**, and (2) the **Modus Tollens**, or the mood that denies the consequent, which is **Destructive**. For instance—

(1) **The Modus Ponens**—

If A, then C,	}	or	If A is B, it is C,
A,			A is B,
∴ C.			∴ A is C.

or If A is B, C is D,	}	or	If not A, then C,
A is B,			not A,
∴ C is D.			∴ C.

(2) **The Modus Tollens**—

If A, then C,	}	or	If A is B, it is C,
not C,			A is not C,
∴ not A.			∴ A is not B.

or If A is B, C is D,	}	or	If not A, then not C,
C is not D,			C,
∴ A is not B.			∴ A.

RULE.—Either the antecedent must be affirmed or the consequent must be denied.† If the antecedent is true, the consequent must be true; and if the consequent is untrue, the antecedent must be untrue.

* Whereas in a *Pure Hypothetical Syllogism*, both premisses and the conclusion are hypothetical.

† Affirming the antecedent reduces to *Barbara*, and denying the consequent to *Camestres*, if we convert the hypothetical into categorical form.

3. **Its Fallacies.**—The following are the two fallacies of the Mixed Hypothetical Syllogism :—

(i) *The Fallacy of Denying the Antecedent* :—A denial of the antecedent does not entitle us to a denial of the consequent. If we infer B from A, we cannot infer not-B from not-A. For instance—

If Napoleon is victorious, he does not need supplies ;

Napoleon is not victorious ;

∴ He needs supplies.

This argument is faulty. Although Napoleon is not victorious, he may still need supplies.

If we convert this argument into categorical form, we have the fallacy of *Illicit Process of the Major* :—

The case of Napoleon's being victorious is a case of his not needing supplies ;

This is not a case of Napoleon's being victorious ;

∴ This is not a case of his not needing supplies.

(ii) *The Fallacy of Affirming the Consequent* :—If we posit the consequent, we are not bound to accept the antecedent. For instance, the following argument is incorrect :—

If it rains heavily, the rivers are flooded ;

The rivers are flooded ;

∴ It has rained heavily.

If we similarly convert this argument into categorical form, it produces the fallacy of *Undistributed Middle*.

4. **Mixed Disjunctive Syllogism.**—This form consists of a disjunctive major premiss, a categorical minor, and a categorical conclusion. This also has two moods :

(1) The **Modus Tollendo Ponens** : the mood which posits the one alternative by rejecting the other ; *e.g.*

$$\left. \begin{array}{l} A \text{ is either } B \text{ or } C, \\ \text{It is not } B \text{ (or not } C), \\ \therefore \text{It is } C \text{ (or } B) \end{array} \right\} \text{ or } \left\{ \begin{array}{l} \text{Either } A \text{ or } B \text{ is } C, \\ B \text{ is not } C \text{ (or } A \text{ is not}), \\ \therefore A \text{ is } C \text{ (or } B \text{ is).} \end{array} \right.$$

These and three others are the different forms of this mood. **Bādhyā Sāmāni**

(2) The **Modus Ponendo Tollens** : the mood which rejects the one alternative by positing the other, *e.g.*

$$\left. \begin{array}{l} A \text{ is either } B \text{ or } C, \\ A \text{ is } B \text{ (or } C), \\ \therefore A \text{ is not } C \text{ (or } B) \end{array} \right\} \text{ or } \left\{ \begin{array}{l} \text{Either } A \text{ or } B \text{ is } C, \\ A \text{ is } C \text{ (or } B \text{ is),} \\ \therefore B \text{ is not } C \text{ (or } A \text{ is not).} \end{array} \right.$$

These and three others are the cases of this mood.

If there are more than two alternatives in the major premiss of a mixed disjunctive syllogism, then either the minor premiss or the conclusion may be disjunctive, *e.g.* :—

$$\left. \begin{array}{l} \text{Either } A \text{ or } B \text{ or } C, \\ \text{Not } A, \\ \therefore \text{Either } B \text{ or } C \end{array} \right\} \text{ or } \left\{ \begin{array}{l} \text{Either } A \text{ or } B \text{ or } C, \\ \text{Neither } A \text{ nor } B, \\ \therefore C. \end{array} \right.$$

It may also be noted that the **Modus Tollendo Ponens** is always valid, but the **Modus Ponendo Tollens**

is only valid if the two alternatives, expressed by 'either — or,' are really *exclusive* of each other.

5. The Dilemma.—The Dilemma is a syllogism in which one premiss (*viz.*, the major) is hypothetical and the other (the minor) is disjunctive. It may be spoken of as a compound hypothetical syllogism, and it "is therefore governed by the laws of the hypothetical syllogism. It must, however, be partly disjunctive in form, seeing that the essence of a dilemma is to present a choice of evils. The disjunction may be offered in the consequent of the hypothetical major premiss but is normally presented in the minor premiss and in the form of a disjunctive proposition."^{*} The term has passed into common speech, and we are said to be in a dilemma when of the two alternatives offered to us we must admit one, but in either case we are caught in a trap by being compelled to admit a repugnant conclusion. The two alternatives offered by anyone to his adversary in disputation are known as the '*horns*' of the dilemma.

The Dilemma is 'the prettiest and dialectically the most effective form of conditional syllogism.'[†] It may be either **Constructive** or **Destructive**. The former is an argument from the affirmation of antecedent to the affirmation of the consequent; the latter proceeds from the denial of the consequent to the denial of the antecedent. Each of these may either be *simple*

* B. Gibson, *op. cit.* p. 271.

† Schiller, *op. cit.* p. 227.

or *complex*. Thus we have the following four varieties of the Dilemma :—

(1) **Simple Constructive** *e.g.*,—

If A is B, E is F ; and if C is D, E is F.

Either A is B, or C is D.

∴ E is F.

or

If he is to survive, medicine is useless ;

if he is to die, medicine is useless.

Either he is to survive or he is to die ;

∴ Medicine is useless.*

(2) **Complex Constructive**, *e.g.*—

If A is B, E is F ; and if C is D, G is H.

Either A is B, or C is D.

∴ Either E is F, or G is H.

or

‘If I cross the field, I shall meet the bull ; and if I go up the lane, I shall meet the farmer.

Either I must cross the field or go up the lane.

∴ Either I shall meet the bull or the farmer.’ (Stock.)

(3) **Simple Destructive**, *e.g.*—

If A is B, C is D and E is F,

Either C is not D, or E is not F.

∴ A is not B.

or

If he were rich, he would keep a motor-car and a landau,

But either he cannot have a motor-car, or cannot have a landau.

∴ He is not rich.

* The following is another example of this type :—

अविज्ञाते परे तत्त्वे शास्त्राधीतिस्तु निष्फला ।

विज्ञातेऽपि परे तत्त्वे शास्त्राधीतिस्तु निष्फला ॥ (विवेकचूडामणिः)

Such examples can easily be multiplied.

(4) Complex Destructive, e.g.—

If A is B, E is F ; and if C is D, G is H ;

Either E is not F, or G is not H ;

∴ Either A is not B, or C is not D.

or

If he were clever, he would see his mistake ; and

if he were candid, he would acknowledge it ;

Either he does not see his mistake or he will not
acknowledge it ;

∴ Either he is not clever or he is not candid.

Now, the student will notice that in a **Simple Dilemma** the conclusion is a simple proposition *; in a **Complex Dilemma** it is a disjunctive proposition. The distinction of the fourfold classification of the Dilemma may thus be summed up in brief :—In (1) the consequents of the two hypothetical clauses are identical ; in (2) they are different ; in (3) there is only one antecedent ; and in (4) there are two.

In the above examples we have only two antecedents or consequents. But the number need not always be confined to two. If we have three of either, it gives us a **Trilemma** ; if four, a **Tetralemma**, and so on to any number. It then becomes a **Polylemma**.

6. **Rebutting the Dilemma.**†—A dilemma is rebutted by constructing a counter-dilemma, in which the

* But a *simple dilemma* is still a “*complex syllogism*.”

† For other ways of answering the Dilemma—viz. “taking it by the horns” and “escaping between the horns” refer to Joyce, *op. cit.* p. 212.

alternatives are the same but they are shown to involve opposite conclusions. These conclusions are such as have been overlooked in the disjunction, which is, as a rule, the weak part of the dilemma.

Rule for Rebutting—Transpose the consequents and change their quality., e.g.

Dilemma :—

If A is B, E is F ; and if C is D, G is H ;

But either A is B, or C is D ;

∴ Either E is F, or G is H.

Counter-dilemma :—

If A is B, G is not H ; and if C is D, E is not F ;

But either A is B, or C is D ;

∴ Either G is not H, or E is not F.

We give below a classical example of a dilemma and the way in which it was rebutted :—

Protagoras agreed to teach Rhetoric to one Euathlus on condition of receiving half the fee at once and the other half when Euathlus won his first case. Euathlus, however, delayed to undertake any suit, and eventually Protagoras himself sued him before the court, and urged the following dilemma against him :—

Most foolish young man, if you win the case, you must pay by our agreement ; and if you lose the case, you must pay me by order of the court.

Euathlus replied :—

Most sapient master, if I win the case I am free by order of the court ; and if I lose the case I am free in terms of our agreement.

The following is another example fully stated :—

Dilemma :—

If a man is married he is miserable, because he has to take care of his wife ; and if he is unmarried he is miserable, because he has no wife to take care of him.

But he is either married or unmarried.

∴ In either case, he is miserable.

Its rebuttal by the following *counter-dilemma* :—

If a man is married he is not miserable, because he has a wife to take care of him ; and if he is unmarried he is not miserable, because he is not to take care of a wife.

But he is either married or unmarried.

∴ In either case, he is not miserable.

Zeno's famous dilemma to prove the impossibility of motion is as follows :—

Motion is impossible ; for a body in motion must either move where it is or where it is not. But a body cannot move where it is, neither can it move where it is not. Hence it cannot move at all.

Here the fault lies in assuming the conclusion in saying that if a body moves, it moves neither where it is nor where it is not. The truth is that a body in motion always moves from where it is to where it is not. We have no right to assume that there is no change of place in motion.

SUMMARY.

Mixed Hypothetical Syllogism has a hypothetical major and a categorical minor. It has two *moods* (1) *Modus Ponens*: Constructive, (2) *Modus Tollens*: Destructive. In the former the antecedent is affirmed, while in the latter the consequent is denied.

Rule.—Either the antecedent must be affirmed or the consequent must be denied.

The violation of this rule gives rise to (1) the Fallacy of Denying the Antecedent, and (2) that of affirming the Consequent.

Mixed Disjunctive Syllogism consists of a disjunctive major and a categorical minor. The conclusion is also categorical.

It has two moods :—

(i) *Modus Tollendo Ponens*—which affirms the one alternative by denying the other.

(ii) *Modus Ponendo Tollens*—which denies the one alternative by affirming the other.

The **Dilemma** is a compound hypothetical syllogism. It consists of a hypothetical major and a disjunctive

minor. It is the prettiest and the most interesting form of conditional syllogism.

It has four forms :—

- (i) Simple Constructive.
- (ii) Simple Destructive.
- (iii) Complex Constructive.
- (iv) Complex Destructive.

A dilemma can be rebutted by transposing and denying the consequents.

CHAPTER X.

FUNCTION AND VALUE OF THE SYLLOGISM.

1. **Characteristics of Syllogistic Inference.**—After passing through the details of the Syllogism we are now in a position to generalise its fundamental characteristics. We have seen its underlying principle to be the application of a generalisation or a universal rule to a particular case ; and this fact is enunciated in the famous *Dictum de Omni et Nullo*, which has been variously interpreted by logicians. The major premiss asserts the existence of a universal condition, the minor premiss cites a case in order to see if it fulfils such condition ; and the conclusion states whether the particular case falls under the general rule or not. A particular case cannot be understood without a reference (implicit or explicit) to its connexion with a universal fact. For that very reason we fail to account for the appearance of a ghost or the illusions of a juggler. Mere collection of particular cases can never explain itself : it must be placed in relation to a generalisation in order that its meaning may be understood. Neither pure generalisations nor mere individual cases constitute our rational knowledge. The former are hollow without the latter, while the latter are blind without the former. The Syllogism, therefore, requires the existence of both, and by subsuming a particular case under a universal law it leads to the discovery of a new relation, which was implicitly contained in the generalisation but which becomes explicit to us only

after such inference has been drawn. And it is this principle which is embodied in the *Dictum* when correctly interpreted: ‘*Whatever satisfies the conditions of a rule falls under that rule.*’

Another characteristic is that if the premisses are once accepted, the conclusion follows with irresistible and intrinsic necessity. This is implied in the very definition of Syllogism given by Aristotle and all other formal logicians. If this is questioned, the Syllogism is deprived of all its incontestable formal validity.

Besides *necessity*, syllogistic reasoning possesses *novelty* as well. Without that, it would be a mere repetition and tautology. Two premisses are so placed together as to yield a *new* truth. Such truth is not, however, excluded from the premisses altogether; but at the time of syllogising we do not explicitly know that it is so involved either in one premiss or in both taken together. The major premiss as a rule implicitly contains the conclusion, and in most cases may itself have been arrived at inductively by observation, abstraction, generalisation, etc., and in that case the conclusion would appear to state no *new* truth. But the major premiss need not be taken as a mere enumerative statement about individual cases—otherwise no *novelty* is possible in the conclusion—but a statement of a universal connexion, *e.g.*, ‘Where there is smoke there is fire.’ We cannot possibly exhaust the particular instances covered by this generalisation; and in Scientific Induction, *e.g.*, only one instance is sometimes enough to warrant the

formulation of a universal law, which can afterwards be tested by means of deductive inference, i.e., by applying it to other particular cases. And such application must give us *new* knowledge. In the scheme of reality itself there is hardly any scope for the existence of *novelty*, but as each one of us cannot transcend the limitations of his world of knowledge, the syllogism does involve novelty in its conclusion for the present state of our knowledge. But novelty is more psychological and less logical from the human and subjectivistic point of view. The relativity of knowledge under the limitations of our consciousness precludes the possibility of a strictly logical novelty which would appeal to all minds as novel. But we must not, on that account, misunderstand the sense in which a syllogism claims novelty in its conclusion.

To recapitulate: there are three principal characteristics of Inference* :—(1) the application of a general law to a particular case, (2) formal necessity of the syllogistic conclusion, and (3) novelty in the

* According to Mr. F. H. Bradley, all inference is a construction (as process) and an intuition (as result); and the union of both is demonstration (*op. cit.* p. 235). Mr. Bradley characterises Inference as follows:—

(1) "Inference is not perception" (as Hindu logicians distinguish *Pratyaksha* and *Anumâna*). So says Kant: "Der Vernunftschluss geht nicht auf *Anschauungen*, sondern auf *Begriffe und Urteile*." Hegel too speaks of the syllogism as the unity of conception (*Begriff*) and judgment (*Urteil*).

(2) Its conclusion is not a mere fragment or isolated unit; it does not exist in and by itself, but is the result of a process. It rests upon a basis already known. In it we advance from a truth possessed to a further truth.

(3) Its conclusion must convey some piece of information, and must tell us something else than the truths it depends upon. But Mr. Bradley does not show much respect for the Syllogism: "The major premiss is a delusion, and this augurs ill we may think for the syllogism," (which) "itself is a mere superstition." (p. 228).

conclusion. We shall now take up the criticism of the syllogism with reference to each of these characteristics.

2. Inference from Particulars to Particulars ; Mill's View Criticised.—We have maintained above that no real inference is possible except by reference to a generalisation ; consequently the procedure from particulars to particulars cannot be called Inference. But that is how Mill characterises inference. He says :—

“ All inference is *from particulars to particulars* : General propositions are merely registers of such inferences already made, and short formulæ for making more. The major premiss of a syllogism, consequently, is a formula of this description, and the conclusion is not an inference drawn *from* the formula, but an inference drawn *according to* the formula ; the real logical antecedent, or premise, being the particular facts from which the general proposition was collected by induction. Those facts . . . may have been forgotten, but a record remains

. . . According to the indications of this record we draw our conclusion, which is, to all intents and purposes, a conclusion from forgotten facts. For this it is essential that we should read the record correctly, and the rules of the syllogism are a set of precautions to ensure our doing so.”

(*Logic*, i, p. 221.)

This sums up Mill's view on the function and logical value of the syllogism. Thus all inference is *inductive*, and syllogism is only the latter half of the process of movement from premisses to a conclusion. Real inference consists in “ collecting ” the universal premiss by an examination of particular facts—i.e., by induction. Syllogism is not a process of inference but

a record of an inference already made (inductively):* a mere deciphering of the notes we have already registered in general propositions.

Mill continues:—

“All our earliest inferences are of this nature....The child, who, having burnt his fingers, avoids to thrust them again into the fire, has reasoned or inferred, though he has never thought of the general maxim, Fire burns. He is not generalising: he is inferring a particular from particulars.” (*ibid.*)

The following is Mill’s statement of the true and universal type of inference:—

“Certain individuals have a given attribute: an individual or individuals resemble the former in certain other attributes: therefore they resemble them also in this attribute.”

Criticism.—Reasoning from particulars to particulars can at best be nothing more than an argument from analogy, in which we reason from the existence of certain partial resemblances. If the real point of resemblance is ignored, we have a *false analogy*—which could be avoided if we viewed the particular fact in its entirety, *i.e.*, in reference to a general rule. Even when we argue that a particular thing resembles another, we base our reasoning on some sort of “general impression.” Thus even here an abstract content is referred to.† If a physician examines a patient and

* “Mill’s refusal to see anything “new” in the conclusion of a syllogism, unless the conclusion be absolutely disconnected with the premisses, makes inference impossible.”—D. G. Ritchie, *Philosophical Studies*, (Macmillan, 1905), p. 203.

† On this point consult Bradley, *op. cit.* p. 325.

Almost all logicians now agree that we cannot pass from particular to particular except through a universal, which is identical amid the difference of these particulars.

prescribes just what he did in another case, he evidently bases his judgment on the *similarity* of symptoms in the two cases, which is itself not a particular. Thus on Mill's theory we have no power of abstraction or generalisation, and consequently are no better than the lower animals, who are slaves of the particular and the present. Mill's contention is professedly psychological, but its psychology is false.* Our reasoning from particulars to particulars is always based on the common qualities which they possess; and this involves a universal fact applicable to particular cases. The universal principle is not a mere *record* or *register* of a past inference, but the logical ground for the conclusion.

3. Paradox of Inference.—Inference appears to be a paradox, if we claim for it both *necessity* and *novelty*. For, it may be said, if the conclusion follows from the premisses with formal necessity, it must already be contained in them: but in that case it cannot possess any novelty. In other words, the conclusion is (*a*) in the premisses, otherwise it cannot follow necessarily from them, and (*b*) outside the premisses, otherwise there is no progress to any new truth. But the

* Dr. S. H. Mellone calls it an "unsuccessful and misleading attempt"; for "though Mill is right when he places the ultimate source of all our knowledge in sense-experience, he entirely misinterprets the nature and function of the higher cognitive faculty of the mind—the intellect or reason—when he teaches that it can merely sum up the individual experiences of sense into collective judgment."—Mellone, *Introductory Text-Book of Logic*, p. 385.

characteristic of *necessity* and *novelty* are mutually incompatible: this constitutes the *Paradox of Inference*.*

But there is no real incompatibility. The conclusion is certainly contained within the system to which it belongs. If it were not *in* the premisses, it could not be created out of them. But our mind cannot but have only a partial view of the system of reality, hence to us the conclusion is actually *not* contained in the premisses. We have to discover it in our own world of knowledge, although logically it is potentially contained in the premisses. This will be more obvious if we add that we take the major premiss in *intension*.† Similarly, with regard to novelty, we might say that such novelty is relative to the state of our own knowledge. It is "new" in the sense that it was not *explicitly* present to our mind. Thus there is logical necessity as well as psychological novelty.‡

* Read Coffey, *op. cit.* i. p. 396 ff, Bosanquet, *op. cit.* p. 137.

† This standpoint is corroborated by Hindu Dialectic, which always takes the major premiss in *intension*.

‡ This is the paradox of inference: "There must be something new, and yet there must not be anything new. It is the old puzzle about the impossibility of learning, raised by the Greek Sophists, and it is only capable of solution, if we are allowed to make the distinction between what is implicit and what is explicit—a distinction which Mill puts aside as "a mere salvo"—and to recognise that identity and difference are not mutually exclusive, a conclusion which cost Plato a great dialectical struggle, and which to modern common-sense still seems absurd."—D. G. Ritchie, *op. cit.* p. 205.

4. Syllogism from the standpoint of New Logic.—We shall now state very briefly the standpoint of the New Logic, as it is being constructed by the Pragmatists these days, and indicate its attitude towards the Syllogism.* We shall mainly confine ourselves to the views of the leading Pragmatist, Dr. F. C. S. Schiller. The New Logic is very hostile to the Syllogism and spares no argument to bring home its uselessness, invalidity and contradictions. It does not view it as a *form* of reasoning possessing necessity and novelty in its conclusion, but only an *experiment*. A syllogism is the application of a general rule to a particular case. We have to select a particular case and see if it comes under a general rule, and the experiment tests the consistency of our knowledge. The conclusion states what we had a right to expect, but it has to be confirmed in fact. And if we had not felt it to be doubtful, we should not have reasoned.

Necessity: The necessity and certainty of the syllogism is the idle boast of Formal Logic. But the doctrine is ambiguous: 'necessarily true' might mean 'dependent on the premisses' or 'true in fact.' In other words, the ambiguity lies in the two meanings

* On this subject read carefully F. C. S. Schiller, *op. cit.* Ch. XVI, esp. pp. 194—204; A. Sidgwick, *op. cit.* Part II, Ch. VII and X; *The Use of Words in Reasoning*, Ch. ii and iv. *The Process of Argument*, Ch. XIII. The Pragmatic view is here summarised after Dr. Schiller, and some statements under this section are based on his lecture-notes, for which we acknowledge our indebtedness.

'true as claimed' and 'true in fact.' If the truth and the necessity are only formal, they remain hypothetical ; if they are factual, the doctrine is false. For it then rests on the assumed identity of the middle term. In point of fact the middle term is ambiguous, and is used differently in the two premisses. Mr. A. Sidgwick shows the possibility of denying the conclusion even after accepting the premisses. The identity of the middle term is only *verbal* and is revealed only when the premisses are actually used. It is a fatal and incurable defect which destroys the syllogism's claim to formal necessity. The syllogism is powerless as a mere logical form. *Satisfaction*, instead of *compulsion*, should be the differentia of truth. The formal cogency is of our own making ; for the selection of the premisses rests on our free choice among the infinite possibilities of knowledge. Moreover, the necessity of the syllogism exists *after* it has been constructed. Thus *formal necessity* turns out to be an illusion created by Formal Logic.

Novelty : Even formal logicians are now agreed that the syllogism is not an instrument of discovery. A non-psychological logical novelty means nothing, and every inference is *psychologically* novel to one or other of the parties concerned. But the sort of novelty depends on human purpose : (1) if we only want to prove a conclusion already reached, novelty is not its primary end ; but (2) if our purpose is to advance from the premisses, a *new* conclusion is desired. Novelty does not lie in the syllogistic *form* A syllogism may

or may not yield new truth. It is neither true that all syllogisms must yield it, nor that none can. In both cases the novelty is *psychological*.

5. **Syllogism as a *Petitio Principii*.**—If the conclusion depends on the premisses, it is already contained in them, and the syllogism is only a *recoil* and not an *advance*. The truth of the conclusion depends on that of the premisses, which in their turn secretly presuppose that of the conclusion. Hence, it is argued, the syllogism argues in a circle or begs the question, the technical name for which is *Petitio Principii*. Thus, Mill says :—

“ It must be granted that in every syllogism, considered as an argument to prove the conclusion, there is a *petitio principii* ; —that no reasoning from generals to particulars can, as such, prove anything ; since from a general principle we cannot infer any particulars, but those which the principle itself assumes as known.” (*Logic*, Book II, Ch. 3.)

But the charge of *petitio principii* will not hold good, if we understand the function of the syllogism aright. If its terms are taken in *extension*, i.e., if the major premiss is formed by an enumeration of instances, every syllogism would be a *petitio principii*. But then there are two points to be noticed :—*

(i) Neither premiss can by itself yield the conclusion ; it is their combination which does so. The conclusion is contained in the meaning of the two premisses taken together.

* A third point may also be noticed, viz., the major premiss is not necessarily arrived at by enumeration, but in other ways as well, e.g., by *intuition*, *fit testimony*, *revelation*, *authority*, etc.

If the major premiss alone were enough for the purpose of inference, the minor would become entirely useless. But the necessity of the minor premiss is not questioned. Hence the syllogism is not a *petitio principii*.

(ii) If the syllogism is read in intension,* if we take the major premiss not as a mere enumeration of individuals but as the statement of a connexion of universal attributes or a law of nature,—there is no *petitio principii*. For instance,

Humanity implies mortality,
Plato comes under humanity.
∴ Plato implies mortality.

Ground of Inference or	M indicates P	e.g., 'Where there is smoke there is fire.'
Major Premiss.		
Fact relied on or Minor	S is M	e.g., 'The hill smokes.'
Premiss.		
Conclusion	... ∴ S is P	e.g., 'The hill is fiery.'

Now, taken in extension, it would mean that among the M's which are P's are included those which are S. In that case the conclusion would be redundant and Mill's remarks would be justified, *viz.*, "The conclusion said to be arrived at is really a part of the evidence for

* In Hindu Logic the syllogism is always read in intension and is therefore free from the fallacy of *petitio principii*.

"*Parvato vahnimān, dhoomavatvāt; yatra yatra dhoomah tatra tatra vahnih.*" This example is used by Mr. A. Sidgwick in illustrating the typical form of the syllogism.—*The Process of Argument*, p. 63.

the major premiss." But it is obvious that here the major premiss does not attempt to enumerate particular cases but simply states a universal law, which is applied to the particular case expressed by the minor premiss. In this way the charge of *petitio principii* cannot hold good.

The New Pragmatic Logic, however, questions even this interpretation and challenges us to say how we came to know that a particular case came under the universal law. To assume this is to assume that the rule applies to the case, that the case is really a case of the law. Thus the syllogism is still a *petitio*, since we assume the application of the rule to the case. Further, if the major is taken as a definition, the *petitio* is simply transferred from the major to the minor.

We have already indicated the sense in which we take *novelty* to exist in the conclusion: That is by itself a reply to the charge of *petitio*. Martineau supports the same view. According to him a "*petitio principii* is entirely relative to the state and range of the individual understanding, and cannot be established as a fault against an argument by merely showing that the inference *might* be thought already in the assumption, but only by showing that it *must* be."*

SUMMARY.

There is always a *universal* element in syllogistic reasoning. Reasoning from particulars to particulars

* Croke, *op. cit.* p. 182.

(Mill's Doctrine) cannot strictly be called Inference. Syllogism is the general type of reasoning, in which the major premiss states a universal rule and the minor places a case under it.

We cannot pass from particular to particular except through a universal, identical amid the difference of these particulars. Hence Mill's view must be rejected.

The conclusion follows from the premisses with certainty, as it is formally contained in them. But at the same time it has some claims to novelty as well. Thus arises the *paradox of inference*: necessity and novelty are mutually incompatible.

But *formal* necessity and *psychological* novelty are not incompatible. All novelty would cease for us, only if our knowledge were complete: in that case all inference would be impossible and unnecessary.

The syllogism may be interpreted in one of the following ways:—

(1) *in extension*: the major premiss will then be based on an exhaustive enumeration of particulars. Obviously it will involve the conclusion. Hence the syllogism is a *petitio principii* from this standpoint;

(2) the major premiss as a *definition*: in this case also the *petitio* exists in the syllogism, although it is transferred to the minor premiss;

(3) *in intension*: the major premiss states a general law, the minor puts a particular case under it. In this sense, the charge of *petitio* cannot be preferred against the syllogism.

Another reason against the charge of *petitio* is that neither premiss can by itself yield the conclusion. It is only when the two premisses are *combined*, that they jointly imply the conclusion (cf. Whately).

The New Pragmatic Logic views the syllogism as a mere *experiment*, and sets up *satisfaction* (instead of *compulsion*) as the differentia of its truth. It also points out that the identity of the middle term is only *verbal*; and the necessity of syllogistic reasoning is wholly *ex post facto*.

CHAPTER XI.

FALLACIES.

1. **Logical Treatment of Fallacies.**—A Fallacy is a deceptive argument: one that appears to be conclusive or valid without really being so. Any argument that does not conform to the principles of correct thinking—which is the business of Logic to expound—is fallacious. Its fault may sometimes be easily detected owing to its being a manifest violation of some logical principle, or it may not be so transparent; it may lurk within the argument masked in ambiguous language; anyway, it implies an infringement of logical principle, and its validity is only *apparent*.

We have defined Logic as the science of right thinking. Are we then called upon to discuss the forms of incorrect thinking? The treatment of Fallacies is no direct aim of Logic as a *science*. But as it is of great utility in teaching us how to detect error in order to avoid it, it is usual—and we should say, perfectly rational—to append a chapter on Fallacies. Logic is not entirely cut off from practice: its practical utility in mental training and its educational value cannot be over-estimated. In Hindu Logic the treatment of Fallacies is not considered extra-logical, but a part of the complex logical doctrine. Aristotle also deals with them in the last book of his *Organon* under the title of *Sophistici Elenchi*. Their treatment is indeed an additional help to the student, as by a knowledge of the more common sources of error he is, as it were,

forewarned to avoid these pitfalls.* It is a negative way of establishing the truth of logical principles. Our knowledge of the ways in which we *ought* to think is made more certain and explicit by a knowledge of the ways in which we *ought not* to think. It is in the treatment of Fallacies that Logic vindicates its claim to be reckoned as a *practical science*.

Aristotle's object in treating of fallacies was to point out the various ways in which the Sophists used to argue illogically. They were men who boasted of their ability to defend with equal force both sides of any argument, and they did not argue with a view to discover truth but to win popular applause and monetary rewards.† As both sides of an argument cannot be *true* from the same standpoint, the Sophists used to reason erroneously, although the errors were not always transparent to the minds of the Athenian youths, who were generally led away by the Sophists' eloquence and phraseology. To bring out the deceptive nature of such arguments was the aim of Aristotle, and as debates used to be conducted by

* The doctrine of Fallacies "is reckoned among the necessary parts of logic, not that we may be able to deceive others, but that we may not be deceived ourselves."—Murray's *Compendium of Logic*, Dublin, 1853, p. 177.

† "The name of *Sophist* was originally a name of honour, and given to all who were skilled in any art or science, but especially to the philosophers. Afterwards, however, it passed to those, who disputed not for the sake of searching after truth, but for gain, victory, or wrangling; and the fallacious syllogisms they employed were called *Sophisms*"—Murray's *Compendium of Logic*, p. 177.

contending parties, he considered certain faults *in dictione*, i.e., errors in the language, which are not directly concerned with *thought*. Of this, however, we shall speak below. But we must, first of all, distinguish Fallacy from Error, Sophism, and Paralogism.

2. Nature of Fallacies.—In a wider sense, Fallacies include all erroneous judgments or beliefs, and as error conforms to no law and its possibilities are countless, their systematic treatment is impossible in this sense. In a narrower sense, they imply the violation of some syllogistic rule. Aristotle rules out the formal fallacies of Four Terms, Undistributed Middle, and Illicit Process, simply because these errors are so manifest that a Sophist could hardly be expected to indulge in them unless he wanted to court defeat. Thus all errors are not necessarily *fallacies*, though all fallacies are *errors*. In order that an error may be called a *fallacy* it must, at all events, possess a semblance of validity. In other words, where an error is not transparent but is disguised under the show of validity, it may be called a *fallacy*.

Further, there are errors which belong to the special sciences whose subject matter is under discussion. It is not the business of Logic, but of those special sciences, to detect such errors. Again, a false conclusion may not necessarily be due to false premisses ; the premisses may be formally valid but materially wrong, because of some defective method having been applied by the special science in arriving at the premisses.

Neither are the errors of our subjective nature (psychological), which are due to various influences, such as our passion, prejudice, education, character, etc., taken account of by Logic. The term 'Logical Fallacy' must, therefore, be confined to those errors which are an infringement of some logical principle, disguised under apparent validity.

Fallacy must be distinguished from Sophism and Paralogism, which are commonly taken as its synonyms. The fallacious arguments used by the Greek Sophists were known as *Sophisms*. A *Sophism* is a fallacy used with the intention to deceive others. *Paralogism* is, on the other hand, a fallacy of whose error the employer is not aware; hence it is a fallacy which deceives the person who uses it. In a wider sense, it signifies a violation of the formal rules of inference. It may, however, be noted that the distinction referred to here is more of a *psychological* nature, as the strictly *logical* point of view has nothing to do with the *intention* or *purpose* of the employer of an argument.

3. Aristotle's List of Fallacies.—The Greeks used to be very fond of entering into dialectical encounters, and consequently Rhetoric played an important part. It was mostly in oral disputations that fallacious arguments were employed, hence Aristotle dealt not only with *thought* but also with *language* as a main source of fallacy. On this basis he divided fallacies into two main classes: (1) *sophismata "in dictione,"* i.e., fallacies in the language; those arising from ambiguity in language, and (2) *sophismata "extra*

dictionem,” i.e., fallacies outside the language; those arising from thought itself, or from sources other than ambiguity of language. Thought may err either in *form* or in *matter**; hence the second class could be sub-divided into *Formal*† and *Material* fallacies, though Aristotle does not follow this step. His division is dichotomous, and is, therefore, complete in itself. But he has not indicated any inner connexion in the various forms he puts under *extra dictionem*. The whole phraseology under Fallacies is derived from Aristotle, and this nomenclature has never been superseded. If we adopt Aristotle's nomenclature, it is better to stick to his classification. The following is Aristotle's List of Fallacies:—

A.—FALLACIES *in dictione*: 6 FORMS.

1. Equivocation: *Equivocatio*; due to ambiguity in a single term.
2. Amphiboly or Amphibology: *Amphibolia*; due to ambiguity in a phrase.
3. Composition: *Compositio*; combining what should be kept separate.
4. Division: *Divisio*; separating what should be combined.

* Thought errs in *form* when some formal law of thought is infringed; it errs in its *matter* when it does not agree with its object.

† *Formal* fallacy results from breaking any rule of the Syllogism. In this Chapter we shall only make a mere reference to *Material* fallacies, which are discussed at length in our *Elements of Inductive Logic*. cf. also pp. 74—76 *supra*.

5. Accent: *Accentus*; ambiguity caused by diversity of accent.
6. Figure of Speech: *Figura Dictionis*; misinterpretation of verbal forms.

B.—FALLACIES *extra dictionem*: 7 FORMS.

1. Accident: *Accidentis*; equating subject and attribute.
2. Confusion of absolute and qualified statement: *A dicto secundum quid ad dictum simpliciter*; ignoring the limitations under which a statement is true.
3. Mistaking the Issue: *Ignoratio Elenchi*; refuting the wrong point or proving the wrong conclusion.
4. Begging the Question: *Petitio Principii*; assuming in some way the very thing to be proved.
5. Consequent: *Consequentis*; inferring from a proposition a conclusion that does not follow from it.
6. False Cause: *Non causa pro causa*; assigning a cause other than the true; assigning an irrelevant premiss.
7. Many Questions: *Plurium Interrogationum*; proposing several questions at a time which cannot be answered by either 'yes' or 'no.'

These thirteen fallacies * are arranged into mnemonic lines as follows :—

AEQUIVOCAT. AMPHI. COMPONIT, DIVIDIT, Acc. Fi.
Acci. QUID. IGNORANS, NON CAUSA, CON.
PETIT. INTER.

All the fallacies enumerated under the first group are those of Ambiguity. Of these, the fallacy of Accent has very weak claims to belong to Logic ; it is nothing more than a mere *trick*. Under the second group, the last, *viz.*, Many Questions, is also more or less of a trick. However, we shall first explain all the fallacies enumerated by Aristotle and then consider various other lists.

4. Equivocation.—The Fallacy of Equivocation arises when any of the three terms of a syllogism is ambiguous ; for instance—

The dog barks ;
The dog is a star ;
∴ A star barks.

or

No human being is made of paper ;
All pages are human beings ;
∴ No pages are made of paper. (Stock.)

* The Formal Fallacies of *Four Terms*, *Undistributed Middle*, *Illicit Process*, and *Negative Premisses* are ruled out by Aristotle from his list for the simple reason that they openly violate one or the other rule of the syllogism and his object was "to enumerate the various modes in which a sophist might snatch an apparent victory."—Stock, *op. cit.* p. 367. "They were omitted because they did not, in Aristotle's view, simulate cogency ; no one who could not detect these ought to undertake a disputation."—Joseph, *op. cit.* p. 536.

This kind of ambiguity is, however, mostly met with in the middle term, when it is called the *fallacy of ambiguous middle*; thus—

All good laws should be obeyed;

Buoyancy is a good law;

∴ Buoyancy should be obeyed.

In each of the above examples, a term has been used in two distinct senses.*

5. Amphibology or Amphiboly.—This fallacy is identical with Equivocation except that the error in this case is not due to ambiguity in a term but in a whole sentence or phrase. The ambiguous structure of a whole proposition gives rise to this fallacy. For instance, “The Duke yet lives that Henry shall depose” is ambiguous, inasmuch as it is not clear whether the Duke will depose Henry or Henry will depose the Duke. Again, ‘If my friend comes here on Monday, the ceremony will be performed and the musical entertainment held on Tuesday.’ Here it is not clear if the ceremony is to be performed on Monday and the entertainment on Tuesday, or both on Tuesday.

6. Composition and Division.—These are the converse of each other. The fallacy of *Composition* consists in assuming things to be true jointly when they are true separately. A term may consist of several

* Consequently these examples also illustrate the fallacy of *Four Terms*, not separately recognised by Aristotle. Obviously a fallacy could be placed under more than a single head.

words ; and this fallacy occurs when we join them together where they should have been kept separate. For instance : ‘ Is it possible for a man who is not smoking to smoke ? ’ ‘ Certainly.’ ‘ Then it follows that a man can do a thing without doing it.’ This fallacy may also be described as arguing from the distributive to the collective use of a term : it arises when a term is used distributively in the major premiss and collectively in the minor premiss. A very common example usually cited is—

Two and three are odd and even ;
But two and three are five ;
∴ Five is odd and even.

The converse of this is the fallacy of *Division*, which is due to our assuming things to be true separately when they are only true jointly. It arises when a term is used collectively in the major premiss and distributively in the minor. For instance—

Five is one number ;
Two and three are five ;
∴ Two and three are one number.

Both these fallacies can also be refuted by showing that they contain *four terms*, since by being taken jointly and separately the meaning of sentences changes.

7. Accent.—This fallacy has hardly any claim to be included in logical fallacies, since it is a mere trick

whereby a slight change in Greek accentuation causes ambiguity. Aristotle mentions it in his list in order to make an exhaustive list of *fallaciæ in dictione*, and observes “Accentuation in written discourse can hardly furnish a fallacious reasoning, but only in written controversy and criticism on the poets;”* in other words, this fallacy very rarely occurs in oral argument. The same fallacy is said to occur in modern languages, when a word is wrongly emphasised, e.g., ‘If *I* had spoken to *him*, things would have been all right.’ It may, therefore, be described as a fallacy due to a misplaced accent or wrong emphasis.

8. Figure of Speech.—This fallacy arises when a similar form of words leads us suppose their analogous meaning, e.g., ‘*visible*’ means ‘that can be seen’, ‘*audible*’ ‘that can be heard’; therefore ‘*desirable*’ must also mean ‘that can be desired.’ Here although the words have the same termination, yet their meaning is not analogous; ‘*desirable*’ actually means ‘that is worth desiring or that ought to be desired.’

Now we turn to Aristotle’s second group, *viz.*, fallacies *extra dictioinem* (outside the language), *i.e.*, those which may be due to errors in the reasoning process or in the premisses. While fallacies under the first group were all due to *ambiguity*, those under this head have no common character.

9. Accident.—This fallacy occurs when we infer that whatever agrees with a thing agrees with its

* *Soph. Elenchi*, Ch. 4 (Poste’s trans).

accident. It is due to a confusion between essential and accidental differences, *e.g.*,

Animal is a word of three syllables ;
 Man is an animal ;
 ∴ Man is a word of three syllables.

or

Kant is not Hegel ;
 But Kant is a man ;
 ∴ Hegel is not a man.

or

Three is few ;
 Eighteen is six times three ;
 ∴ Eighteen is few.

This fallacy is now wrongly identified with *Secundum Quid*, the one which we are considering next, so that, as Mr. Joseph remarks, “what to-day is commonly called *accident* is what the Aristotelian tradition called *Secundum Quid*. But because the tradition recognised them as two, a distinction between the *direct* and the *converse* form of the latter fallacy was drawn, which is really quite unsubstantial.”*

10. **Secundum Quid.**—There is no suitable English name for this fallacy. Its complete statement is—*A dicto simpliciter ad dictum secundum quid* ; and sometimes its converse (*viz.*, *a dicto secundum quid ad dictum simpliciter*) is also distinguished.

It consists “in using a principle or proposition without regard to the circumstances which modify its

* *Op. cit.* p. 547.

applicability in the case or kind of case before us" (*ibid*). In other words, it occurs when a statement absolutely true is used as if it were true under certain conditions or limitations, and *vice versa*. It is due to a confusion of absolute and qualified statement. For instance—

Man is mortal ;
 ∴ Man is mortal as to his soul.

or

Man is immortal as to his soul ;
 ∴ Man is immortal. (Murray.)

This is one of the commonest fallacies. We frequently ignore the limitations under which a statement is true. We commit this fallacy, *e.g.*, when we reason : ' Because fur coats are a necessity in England during winter, they must also be a necessity in Bengal during winter ' ; but we forget that what is suitable under certain limitations is not suitable under all conditions. Father Joyce gives another example : " Indeed, it is commonly said that we have in certain cases done positive harm by imposing English methods on races to which they were unsuited. Our legislators, arguing too hastily *a dicto secundum quid ad dictum simpliciter*, judged that what was adapted to Englishmen would be equally serviceable to the Hindu."*

11. **Ignoratio Elenchi.**—*Elenchus* means an argument employed to refute our adversary by proving the

* *Op. cit.* p. 276.

contradictory of his conclusion. The fallacy of *ignoratio elenchi* arises when something is proved, which does not contradict our adversary's position. It is an argument based on mistaking the real issue, and the term literally signifies 'ignorance of the nature of refutation,' or 'ignorance of the proof.' For instance—

Man is subject to law ;
 ∴ Man is free.

Here 'being subject to law' and 'being free' are not mutually contradictory, and both statements may be true. Lawyers whose case is weak frequently employ such arguments.*

This fallacy has many forms, of which the *argumentum ad hominem* is generally referred to. It consists in leaving aside the real issue of the case in hand and turning to the character or position of the persons engaged in it. There is a famous story of a Mr. Kiefe, engaged by the prosecution, having been attacked by the counsel for the defence (whose case was very weak) as follows :—

"Mr. Kiefe O'Kiefe,
 I see by your brief o'brief
 That you are a thief o'thief."

* Another instance of the fallacy is, as we have in Thucydides—Cleon argued that it would be *just* to put the Mitylenians to death. Diodatus reminded him that that was not the question ; the question really before them was whether it would be *expedient* for the Athenians in their present circumstances to undertake it. (Thucydides, Book III, Year 5.)

These remarks are said to have disconcerted Mr. Kiefe and tickled the jury, resulting in a verdict for the defence.

12. Petitio Principii.—This fallacy occurs when we *beg the question*, i.e., assume the very point to be proved. According to Aristotle, there are five ways in which this fallacy occurs:—(1) when we assume the very proposition we are called upon to prove; (2) when for the proof of a particular proposition we assume a universal principle, which can only be established on the proof of that particular; (3) when we assume a particular to prove the universal which involves it; (4) when we break up the proposition to be proved and assume the particulars successively; (5) when two facts are reciprocally involved and we assume one to prove the other. Of these forms, only the first two are important.

The fallacy of *Arguing in a circle* is the most plausible form of *Petitio Principii*. We need hardly dwell upon such fallacies, as they are not due to an infringement of some *formal law*.

13. Consequent.—The Fallacy of the Consequent (i.e., a fallacious consequence) occurs when from a proposition we draw a conclusion that does not follow from it. It is the assertion of a conclusion that has no real connexion with the premisses, e.g.—

If it has rained, the ground is wet;
 ∴ If the ground is wet, it has rained.

* See Poste, *Aristotle on Fallacies*, p. 181. See also Stock, *op. cit.* p. 382.

This corresponds to the simple conversion of A, which is not permissible.

14. False Cause.—This is another inductive fallacy, and we might dispose of it in a few words. It consists in assuming without sufficient proof that one thing is the cause of another. A common instance of the fallacy of *non causa pro causa* is to assume that one thing is the effect of another, simply because it has followed the latter. This form is also known as *Post hoc ergo propter hoc*.

15. Many Questions.—This consists in combining two or more questions in one, and thus laying the snare for the adversary in insisting on a single answer. Thus, 'Are honey and gall sweet?' cannot be answered in a single word. The two parts of this question have to be taken up separately.

It may now be observed that under the first group Aristotle places Fallacies of Language only, and under the second he mixes up Formal and Material Fallacies. Some logicians* have identified Aristotle's Fallacies of Language (*in dictione*) with Formal, and Fallacies outside the language (*extra dictio*nem) with Material Fallacies. But this is distinctly erroneous. The principles of division in the two cases are entirely different. The following is an analysis of Aristotle's scheme:—

Fallacies	... {	(1) <i>in dictione</i> ,— (i.e., in the language).	Ambiguity in 6 ways.
		(2) <i>extra dictio</i> nem, (i.e., in the thought itself.)	

{ (a) Formal.
(b) Material.

Now we shall refer to some other classifications of Fallacies.

Among them is Jevons.

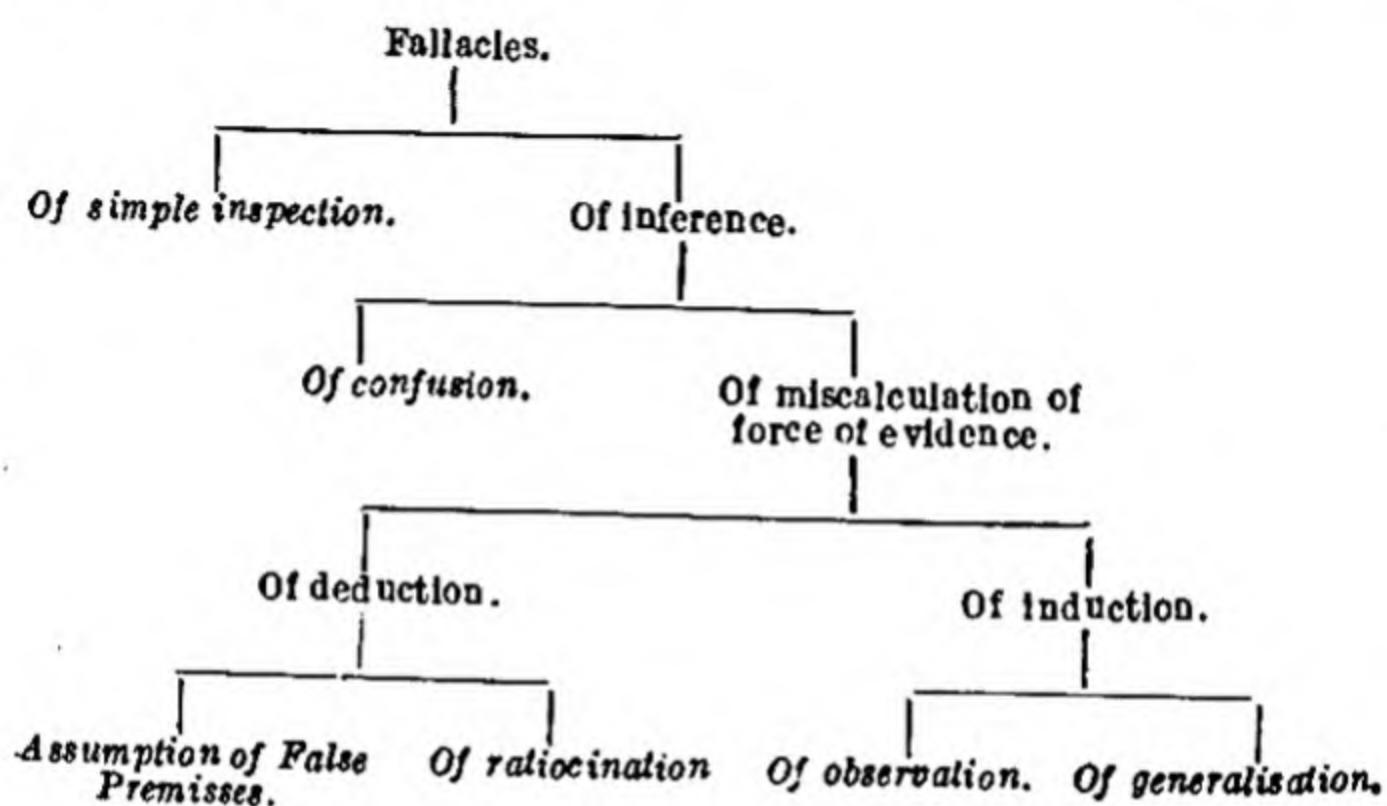
16. **Whately's Classification.**—Whately† objects to Aristotle's classification as not based on any distinct principle of division. He himself proposes another scheme. He divides Fallacies into (1) **Logical**, and (2) **Non-logical or Material**. The former are those in which the conclusion does not follow from the premisses, while in the latter the conclusion does follow but the error lies either in the falsity of the premisses themselves or in some other kind of assumption (*i.e.*, the fault lies in *matter*). The former are again divided into two groups: (i) *purely logical*, in which the error is transparent, and (ii) *semi-logical*, in which the error can be discovered only if we attend to the ambiguity of the terms employed.‡ The following represents a complete classification of fallacies according to Whately:—

Fallacies ...	1. Logical ...	(i) Purely Logical	Four Terms.
			Undistributed Middle.
		(ii) Semi-Logical	Illicit Process.
			Negative Premisses.
			All those in Aristotle's List of 13 Fallacies except those shown under "Material."
	2. Material ...	Ignoratio Elenchi.	
		Petitio Principii.	
		Non causa pro causa.	

† Whately defines Fallacy as "any unsound mode of arguing which appears to demand our conviction, and to be decisive of the question in hand, when in fairness it is not."

‡ Mr. Joseph speaks of Whately's nomenclature as "unfortunate," for, "according to his own definition of a *logical* fallacy, those which lie in ambiguity of language are altogether and not only half logical."—*op. cit.* p. 534.

17. **Mill's Scheme.**—Mill defines Fallacies as a "catalogue of the varieties of apparent evidence which are not real evidence."* He divides them into five classes as follows :—



The five kinds are :—

- (1) Of simple inspection—identified with 'assumption of false premisses.'
- (2) Of confusion.
- (3) Of ratiocination.
- (4) Of observation.
- (5) Of generalisation.

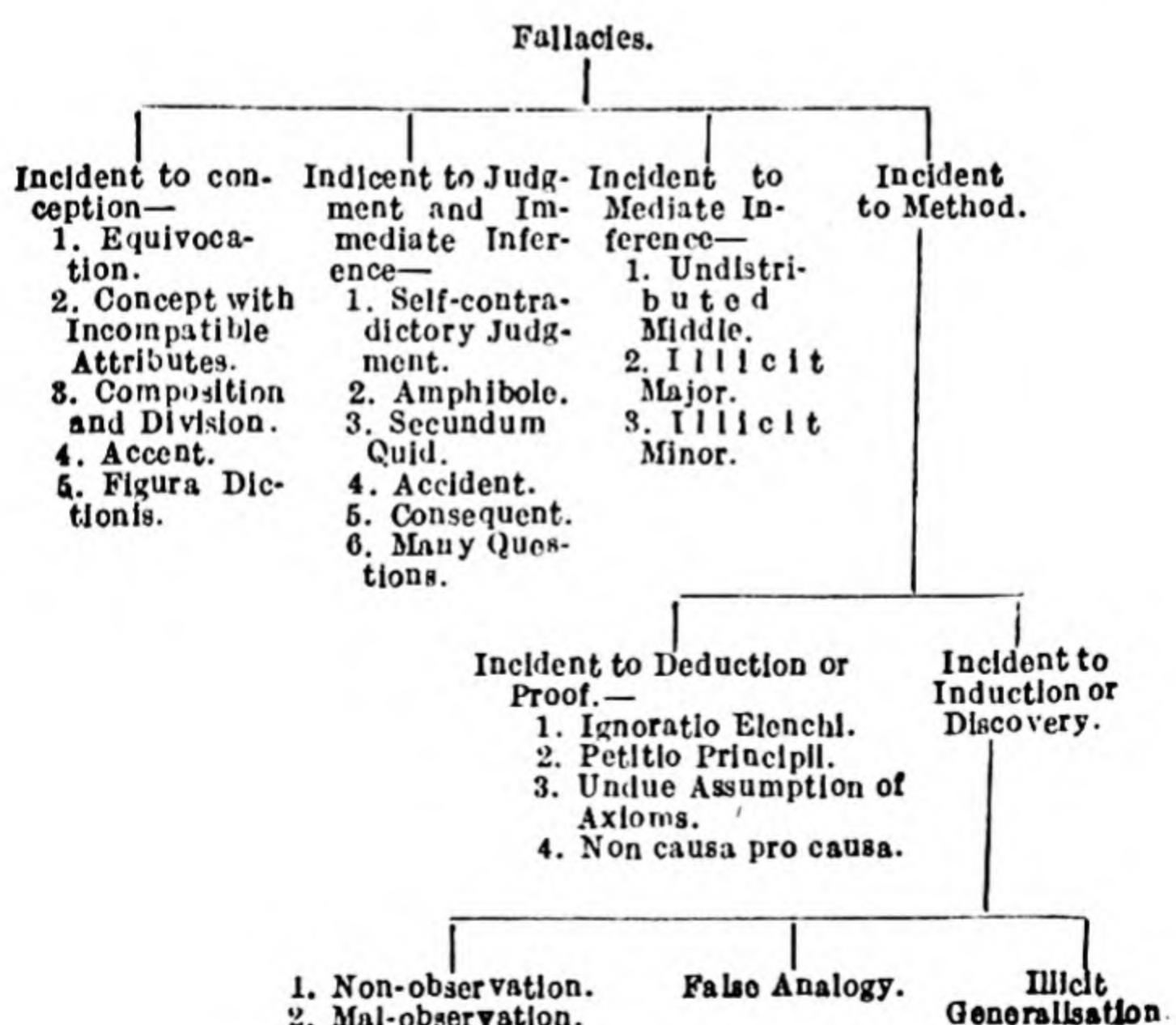
18. **Bacon's Idola.**—Bacon's chief problem was the interpretation of Nature. He held that the highest end of science was to understand and rule Nature. A correct knowledge of nature was possible only after we had purged our mind of all its prejudices and illusions, which he called "*Idola*." They are the

* Mill, *Logic*, V. I. See also Coffey, *op. cit.*, vol. ii, p 299.

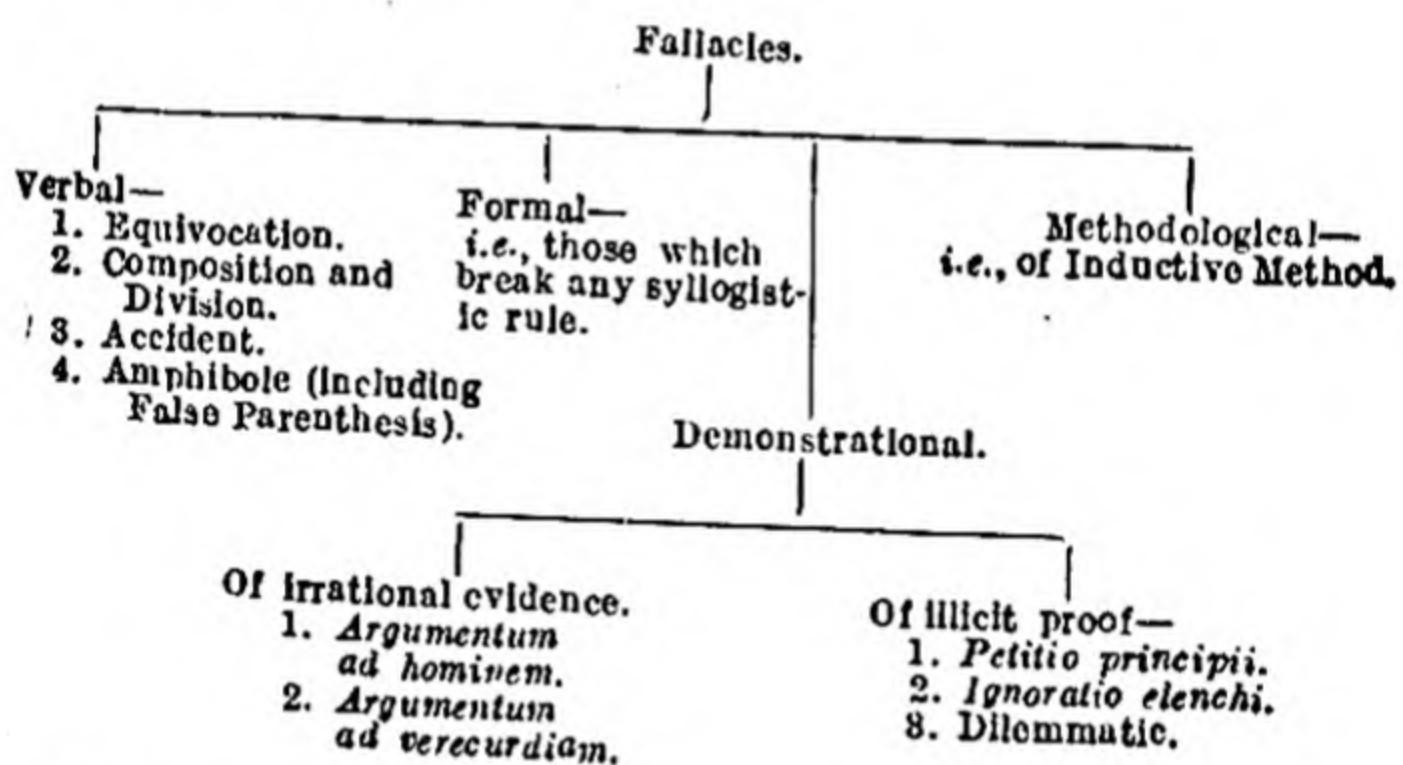
sources of error. They are perversions of pure experience—false appearances. They are *four* in number:—(1) *Idola Tribus*: errors inherent in human nature; belonging to the human race generally, not to the individual; (2) *Idola Specus*: errors peculiar to the individual; (3) *Idola Fori*; errors due to an improper use of language among men; (4) *Idola Theatri*: errors arising from the various dogmas of philosophy and perverted rules of demonstration.

19. Some other Schemes.—Other classifications have recently been proposed according to the sources of error. We shall mention two of these:—

(1) Professor Welton's Classification of Fallacies:—



(2) Mr. Boyce Gibson's Scheme. * — This scheme is based on tracing the sources of error to an infringement of the fundamental principles of Logic, which are taken to be four, *viz.*, the Principles of (i) Definition, (ii) Inference, (iii) Proof, (iv) Inductive Method. Corresponding to these there are four main sources of fallacy, *viz.*, (i) Ambiguity, (ii) Invalidity, (iii) Inclusiveness, (iv) Breach of Method. These are further subdivided as follows :—



20. Scheme of Fallacies in Hindu Logic.—As Aristotle takes no notice of *purely formal* fallacies, so there is no room for them in Hindu Logic too. The reason is that such fallacies are too transparent. Neither does Hindu Logic treat of fallacies *in dictione*; this task is entrusted to Grammar and Rhetoric. Hence Material fallacies alone are dealt with in the Nyâya-Vaisheshika systems. In Deductive Logic we need not discuss those fallacies at all; we shall only give their names.

* *Op. cit. ch. xxxiii.*

A fallacy is known as हेत्वाभास, and may be defined as हेतुलक्षणरहितहेतुमदवभासमानत्वम्, i.e., an argument which appears to be valid but in reality does not conform to logical principles. The following table shows the five kinds of Material Fallacies :—

हेत्वाभास	1. अनैकान्त	साधारण—Reason too wide.
		असाधारण—Reason not referring to similar instances.
		अनुपसंहारी—Reason not referring to dissimilar instances.
	2. विरुद्ध	Contradiction.
	3. असिद्ध	Inconclusiveness { आश्रयासिद्ध खण्डपासिद्ध व्याप्रत्वासिद्ध
	4. सत्प्रतिपक्ष	
	5. वाधित	Absurdity

Definitions of the five kinds of fallacies :—

- पक्षसपक्षविपक्षवृत्तिः हेतुः
- पक्षविपक्षयोरेक एव वर्तमानो हेतुः
- अनिश्चितपक्षवृत्तिः हेतुः
- साध्यासाधकपक्ष एव वर्तमानो हेतुः
- प्रमाणवाधिते पक्षे वर्तमानो हेतुः

These fallacies are explained in our “*Elements of Inductive Logic*,” and as they do not directly bear on our Formal Doctrine, we have not attempted to render their technical definitions into English. The student of Hindu Logic will find some useful facts in

Appendix B. The following explanation of the technical terms will suffice here :—

The Major Term which is always the predicate of the conclusion is called सत्य; the Minor Term, the subject of the conclusion, is known as पक्ष. The Middle Term is denoted by the word हेतु or लिङ्ग. Apart from their place in a syllogism, the subject-term of a proposition is called व्याप्ति, and the predicate व्यापक.

Fallacies constitute one of the sixteen fundamental Topics, whose correct knowledge secures for us, according to the Nyâya system, निःश्वेयस्, i.e., the *summum bonum*, or *non plus ultra*, or complete freedom from all kinds of pain.

SUMMARY.

Fallacies are deceptive arguments. A knowledge of the ways in which we *ought not* to reason helps us indirectly in our knowledge of the ways in which we *ought* to think. Fallacies are an infringement of some logical principle. Those which violate any syllogistic rule are called **Formal Fallacies**, while those in which there is a disagreement between the thought and the subject-matter are known as **Material Fallacies**.

Fallacies must be distinguished from (1) Sophisms, which are employed with the purpose of deceiving others, and (2) Paralogisms, which deceive the person who uses them.

Formal Fallacies are :—(1) Four Terms, (2) Undistributed Middle, (3) Illicit Process, (4) Negative

Premisses—and, if Hypotheticals are treated separately, to these may be added, (5) Affirming the Consequent, and (6) Denying the Antecedent. All these have already been discussed under the Syllogism.

Aristotle mentions two classes of fallacies; (1) *in dictione*, and (2) *extra dictioem*; in other words, those arising from ambiguity in the language, and those due to the thought itself. Both Formal and Material Fallacies are therefore covered by his *extra dictioem*. Under the first group he mentions six, *viz.*, Equivocation, Amphibole, Composition, Division, Accent and Figure of Speech; and the second group contains seven, *viz.*, Accident, *Secundum Quid*, *Ignoratio Elenchi*, *Petitio Principii*, *Consequent*, *Non causa pro causa*, and *Plures Interrogationes*. These seven are rather placed together without any organic principle of connexion.

Whately proposes another classification, *viz.*, Purely Logical, Semi-Logical and Material. The first covers all those resulting from the violation of any syllogistic rule (which are not enumerated by Aristotle); the second includes all those mentioned by Aristotle except *ignoratio elenchi*, *petitio principii* and *non causa pro causa*, which are classed as Material Fallacies.

For other classifications, such as Mill's, Welton's, Boyce Gibson's, see *supra*.

APPENDIX A.

NOTE ON THE HISTORY OF LOGIC.

Logical consciousness is rooted in the Will to Truth—"der Wille zur Wahrheit." Logic may be viewed as an inquiry into Truth; and Truth may consist in the consistency between our thoughts or in the conformity of our thought to reality. The latter aspect aims at the discovery of general laws through an examination of concrete facts; the former attempts to discover certain *a priori* laws to which thought must conform in order to be free from inconsistencies and contradictions, and it was this aspect of logical inquiry which gave rise to Formal Logic. In its wider sense, Logic includes the Theory of Knowledge (*Erkenntnistheorie*) as well. A glance through the history of the logical doctrine will show us how the two opposite tendencies, *viz.*, the psychological (biological) and the anti-psychological have marked the main directions for the development of logical thought. The old logic was *static*, and it has now been rejected in favour of the new *dynamic* logic. The former viewed the concept (corresponding to the Term) as the unit of thought, and the judgment as a synthesis of two concepts; the latter takes judgment as the true unit of thought, and Syllogism as the development of Judgment in a complete system of thought. This dynamic conception was brought out by Hegel, who has greatly influenced modern European thought. Along with the conception of *organic logic* has come into prominence only recently what is known as *Instrumental Logic*, worked out by the Pragmatists.

Although Socrates emphasised the merits of Definition and Induction, and Plato built up a Dialectic, it was Aristotle who really laid the foundations of Logic in the West. His was the formalistic logic of *concept*; and it was closely related to Language, Grammar and Rhetoric. He founded the Categorical Syllogism

and recognised the first three figures only. His doctrine was further developed by two Peripatetics, named Eudemus and Theophrast, who also founded the Hypothetical and Disjunctive Syllogisms. The Stoics' logic was also formalistic, while the Epicureans set up their doctrine of Induction and Analogy. Porphyry brought in the controversy about the meaning of 'universals,' which was kept up in Scholastic Logic. The scholastic logicians developed the principles laid down by Aristotle towards a predominantly deductive and formal treatment of thought.

With the dawn of a new conception of truth and reality in the sixteenth and the discoveries of physical science in the seventeenth century, attention was directed more towards the way in which universal truths are gradually arrived at. Thus Bacon laid down the foundation of *Inductive Logic*. He said : " *Logica, quæ nunc habetur, inutilis est ad inventionem scientiarum.*" Descartes criticised ' Dialectic ' and expounded his Rules of Method.

When we come down to Kant, we find him distinguishing between Formal and Transcendental Logic. The former is anti-psychological ; the latter is material : a theory of knowledge. Formal Logic deals with abstract thought, and is not an *organon* but a *canon* of the understanding. It is a science of the *a priori* laws of the understanding, to which all correct thinking must conform. Transcendental Logic is, on the other hand, the " *Erkenntnistheorie*," and is divided into Analytic and Synthetic; and the former is a Logic of Truth, based on the principles without which no object could be thought of.

As a reaction against Logical Formalism arose Metaphysical or Ontological Logic, which identified the forms of Thought and Being. Thus Hegel identified Logic as Dialectic with Metaphysics, and conceived it as the " *Grundwissenschaft*," and a system of the unity of subject and object.

Herbart revived once more the conception of Formal Logic which he treated as a normative science ; and he was followed by Drobisch, Waitz, Zimmermann and others. Professor

Croce also defends Formal Logic. Hamilton defined it as "the science of the laws of thought as thought," and Whately as "the science and art of reasoning." Mill emphasised the importance of Methodology and laid down his canons of Inductive Method. Bain defined it as "a body of doctrines and rules having reference to truth." Thus the English Associationists placed Logic on a more or less psychological basis. Jevons defines it as the science of the necessary laws of thought; and Dr. Venn points out that it aims at explaining and systematising the facts of the world throughout their widest possible extent.

Henceforth the controversy is not so much between *formal* and *material* logic, as between the *psychological* and the *anti-psychological*. Psychological Logic found its adherents amongst those who criticised Hegel's doctrine of the *identity* of Thought and Being, and maintained a *parallelism* or *correlation* between the two. The names of Schleiermacher, Braniss and Beneke may be mentioned in this connection.

Against this Psychologism, we have, among others, Prof. Külpe, who defines Logic as a normative (not psychological) science. Riehl also opposes Psychologism. Others whose conception of Logic is anti-psychological are, Mr. F. H. Bradley, Prof. Bosanquet, Mr. Bertrand Russell (who conceives Logic as a general part of Mathematics), Mr. Joachim, Dr. Venn, Jevons, and Schröder.

At the same time Avenarius and Mach speak of the psychological and biological grounds of Logic. Their view is shared by Kleinpeter, Ribot, Jerusalem and others. But now a new school has also arisen with a view to reconcile the extreme types of Psychologism and Anti-psychologism in Logic. It maintains that between these two extreme views there lies another standpoint which would accept Psychology only as a resource, "*Hilfsmittel*"—helpful in the development of logical theory. Logic may thus be grounded in Psychology but in itself it is not Psychology. The chief representatives of this standpoint are Professor Wundt of Leipzig and Prof. Höffding of Copenhagen, both of them psychologists of great reputation.

Side by side with the idealistic reaction against the dominance of the scientific spirit, as is, for instance, vigorously preached by Prof. Rudolf Eucken of Jena, there has also appeared during the last 30 or 40 years a marked reaction against Absolutism. This reaction has been named Pragmatism or Humanism or Instrumentalism. Pragmatism is at best a *method* but is also viewed as a new theory of Truth. It has, therefore, a close bearing on Logic. Thus we have a new logic based on Pragmatism. Charles Pierce, the first to write on Pragmatism some 40 years ago, calls it the Logic of Relatives; Mr. Bertrand Russell speaks of it as the Logic of Relations; and Kempe names it the Theory of Mathematical Form. Prof. Dewey builds up his Instrumental Logic, whose task is to discuss the relation of thought as such to reality as such. Dr. F. C. S. Schiller of Oxford bases logical values on psychology and calls attention to the fact that thought is always purposive. Hence Logic must also be relative to *purpose*. Formal Logic, he holds, is full of contradictions and inconsistencies. True logic must take into account the extra-logical and the psychological. The abstraction of formal truth from truth in point of fact everywhere leads to failure. "It is *not* possible," says he in his Preface to *Formal Logic* (1912) "to abstract from the actual use of the logical material and to consider 'forms of thought' in themselves, without incurring thereby a total loss, not only of truth but also of meaning." With him we might also mention the name of Mr. Alfred Sidgwick, who is another acute critic of Formal Logic. He has outlined the defects of the old Traditional Logic and has sketched the general principles on which to build up a new Logic in Part II of his recent work *Elementary Logic* (1914). He traces the defects of the old Logic to shallowness and excessive "abstractness" of view, and claims the following merits for his "New Logic" * :—

1. The intricacies of Mood and Figure are swept away.
2. The distinction between the categorical and the hypothetical syllogism and other minor distinctions belonging to the former are also swept away.

* See also *Mind*, vol. II. N. S., No. 6; and A. Sidgwick, *The Process of Argument*, London, 1893, p. 109.

3. The distinction between Inductive and Deductive Logic also ceases to exist.
4. The central subject of Logic becomes the *risks of reasoning*, so far as they admit of being recognised and understood.
5. The structure of reasoning consists throughout of the *application of rules to cases*.
6. The simplification of technicalities, which need not be learnt for their own sake but may be subordinated to a particular use and purpose.

APPENDIX B.

NOTE ON HINDU LOGIC.

Of the six orthodox systems of Hindu Philosophy, the *Nyāya* of Gautama, and the *Vaisheshika* of Kanâda, are usually considered to form 'Hindu Logic.' But the term is misleading. There is no such thing as Pure Formal Logic among the Hindus; all the six systems have room for logical theories, but each of them aims at presenting a complete system of philosophy from its own standpoint. Each school has its own means to recommend for the attainment of the common goal, *viz.*, complete freedom from pain, *i.e.*, happiness, or *moksha*. There is no divorce between Philosophy and Life. Now, the *Nyāya-Vaisheshika* systems (which may be looked upon as one system in spite of their minor differences) propose to consider what they hold to be the only means for the attainment of salvation, and in doing so they treat of logic as well, though they are much more than logic. Of course they treat of the logical doctrine in more detail than other systems, hence they are usually regarded as systems of Logic. The term Dialectic would, however, be a better rendering than Logic.

Man's *summum bonum* is *moksha*, *nihshreyas*, *apavarga*, *i.e.*, happiness or the complete destruction of pain. This can be attained, according to the *Nyāya* system, by a right knowledge

of the following 16 Topics :—(1) प्रमाण Proof, (2) प्रमेय Objects of knowledge, (3) संशय Doubt, (4) प्रयोजन Purpose, (5) दृष्टान्त Example, (6) सिद्धान्त Doctrine, (7) अवयव Premisses, (8) तर्क Argument, (9) निर्णय Conclusion, (10) वाद Ratiocination, (11) जन्म Sophistry, (12) वितर्का Wrangling, (13) हत्ताभास Fallacies, (14) छल Quibbles, (15) जाति False Analogy, (16) निग्रहस्थान Unfitness for arguing.

Of these, the first two, *viz.*, प्रमाण and प्रमेय are the most important. If this system had treated of प्रमाण only, then it could have been appropriately identified with Formal Logic. But we now see how this is only *one* of the topics discussed in it. We shall first dispose of प्रमेय the objects of knowledge, and then deal with प्रमाण, the means of knowledge.

(.) THE DOCTRINE OF प्रमेय

We have spoken of the 16 Topics mentioned by Gautama. Kanâda, on the other hand, enumerates only 6 *Padârthas*, by a right knowledge of which man's ideal could be realised. The six Categories are :—(1) द्रव्य Substance, (2) गुण Quality, (3) कर्म Action, (4) सामान्य Community, (5) विशेष Difference, (6) समवाय Permanent Inherence. To these, a seventh category, *viz.*, अभाव Negation, was added later on. All these categories can obviously be placed under प्रमेय, hence it is absolutely incorrect to say that Gautama's sixteen *Topics* are identical with Kanâda's six *categories* (which really form only *one* Topic in Gautama's list). Everything we can think of can be placed under one or the other of these categories. Thus the Categories are ontological realities and not merely logical forms. All our experience is resolvable into them, and if we can thoroughly understand their nature, we thereby possess सम्यक् ज्ञान, the only means to salvation. Each of these Categories is further subdivided in classes, *e.g.*, द्रव्य (substance) is divided into Earth, Water, Light, Air, Ether, Time, Space, Soul, and Mind. It is quite unnecessary here to enter into any of these details,

but the mere fact is enough to show the vast range of problems discussed by the Nyâya-Vaisheshika systems of Hindu Philosophy. We now proceed to the doctrine of प्रमाण (Proof, or Means of knowledge), which more exclusively bears on Logic.

(ii) THE DOCTRINE OF प्रमाण

For the realisation of our life's ideal, we require right knowledge, called प्रमा. We have spoken of the Categories as the objects of such knowledge. Now, the means through which it can be obtained are known as **Pramânas**.

Thus—प्रमा=यथार्थज्ञानं or सत्यगतुभवः, and प्रमाण=प्रमायाः करणम् or सत्यगतुभवसाधनम्; and प्रमा=संशयविपर्ययादिरहितं ज्ञानम् i.e., knowledge free from any doubt or contradiction is Right Knowledge. Hindu Logic recognises four kinds of प्रमाण, viz., (1) प्रत्यक्ष Perception, (2) अनुमान Inference, (3) उपमान Analogy and (4) शब्द Testimony. Of these four instruments of knowledge, it is the second, viz., a Theory of Inference, which is exclusively logical in treatment. Here, again, we do not see any artificial distinction between Deduction and Induction. They are regarded as mere moments of a complete process of Inference. Terms and Propositions are not treated here, since they are discussed in Grammar and Rhetoric. Thus Logic is a doctrine of the Syllogism, or a theory of Inference. The following table sums up these facts:—

Knowledge	{	1. Perception (अनुभव)	{	1. Right (प्रमा)	{	1. Sensuous प्रत्यक्ष
				2. Wrong (मिथ्याज्ञान)		2. Inferential अनुमिति
	{	2. Remembrance (स्मृति)	{	3. Analogous उपमिति		4. Authoritative शब्द
				2. Remembrance (स्मृति)		

The four kinds of प्रमा result from the four kinds of proofs respectively, प्रत्यक्ष, अनुमान, उपमान, शब्द. The Vaisheshika

school, however, recognises only the first two kinds of Proof. On two different *fundamenta divisionis*, Inference is divided into three kinds and two kinds respectively :—

(i)

અનુમાન

Inference.

1

पर्वत

Based on
Cause.

श्रीषदत

Based on
Effect.

सामान्यतोदृष्ट

Based on.
Concomitance.

(ii) अनुसार

Inference

Inference for Ourselves

Inference for others.

(a) स्वार्थानुमान

This is defined as **खानुमतिहृतः**, knowledge for one's self. This process is composed of the following steps:—(a) We have already arrived at a generalisation (inductively), e.g., 'Where there is smoke, there is fire' (यत्र ए धूमः तत्र ए वज्ञः), which is known as **व्याप्ति** i.e., universal or invariable concomitance; (b) We approach a mountain, observe a streak of smoke issuing from it and doubt if there is fire; (c) We remember the *vyāpti*, viz., the general rule that wherever smoke exists, there must also be fire; (d) We at once conclude that the mountain must also be fiery. Thus **खार्यानुमान** is based on the consideration that 'this mountain has smoke, which is constantly accompanied by fire'—which is known as **परामर्श**. **परामर्श** also exists in **परार्थानुमान**; in fact, no inference is possible without **परामर्श**.

(b) परार्थनिमान

This process is employed to convince others of the truth we have already known by स्वार्थानुसारं. This consists of five steps पञ्चावयवः—

प्रतिज्ञा (Thesis)—The mountain has fire.

क्षेत्र (Reason)—Because it has smoke.

उदाहरण (Instance)—e.g., in the kitchen hearth (remember the व्याप्ति between smoke and fire).

उपनय (Application)—The mountain has smoke.

निगमन (Conclusion)—Therefore, it has fire.

The steps in स्वार्थनुमान are actually reduced to three, and they correspond to Aristotle's syllogism; परार्थनुमान adds two more steps to make the argument more persuasive and to be more rhetorical:—

स्वार्थनुमान	<i>Aristotle's Syllogism.</i>
यत्र ए धूमः तत्र ए वक्षः	Whatever smokes is fiery;
धूमवानयं पर्वतः	This mountain smokes;
∴ अयं पर्वतो वक्ष्यमान्	∴ This mountain is fiery.

Of the five steps of परार्थनुमान, either the first three or the last three are by themselves sufficient to form a syllogism, but the five-membered syllogism distinctly shows a combination of the Inductive and Deductive syllogisms. The general rule i.e., व्याप्ति, is obtained by the examination of several examples—the typical one is stated in the syllogism itself—and then a particular case is proposed, the general principle is recollected and applied to the case. This gives the conclusion.

STATEMENT OF THE SYLLOGISM.

Aristotle read the syllogism in *extension* and we have already pointed out how on this view it is open to the charge of *petitio principii*. In Hindu Dialectic, however, it is read in *intension*, which is the correct way:

Aristotle.

Kandda.

All men are mortal; Humanity is pervaded by mortality;

Kings are men; Kinghood is pervaded by humanity;

∴ Kings are mortal. ∴ Kinghood is pervaded by mortality.

We need not consider here the function of उदाहरण (which is not more than a suggestive example reminding us of the व्याप्ति) the kinds of Inductive Inference (वौत and अवौत) and

the three types of व्याप्ति, viz., अन्वयव्यतिरेकी, e.g. 'Where there is smoke, there is fire'; केवलान्वयी, e.g. 'Whatever is cognisable is nameable'; and केवलव्यतिरेकी e.g. 'Earth is different from the other elements, because it is odorous.' These details have very little bearing on Deductive Logic.

STRUCTURE OF THE SYLLOGISM.

Like Aristotle's syllogism, the Hindu Syllogism also contains three terms and three propositions. Every proposition has two terms, the subject (व्याप्ति i.e., what is pervaded) and the Predicate (व्यापक i.e., what pervades). They have other names when used in syllogism; the subject is called पक्ष; the Predicate साध्य; and the middle term हेतु or लिङ्ग, lit. sign of comparison. Thus we have—

M—P	Corresponds to	हेतु—साध्य
S—M		पक्ष—हेतु
—		—
∴ S—P		∴ पक्ष—साध्य

Major Term : साध्य

Minor Term : पक्ष

Middle Term : हेतु

Inference in Aristotle's sense corresponds to परामर्श, i.e., the process in which we try to find in a particular case some characteristics which are measured by a mark common to both; in other words, looking out for a suitable middle term, by which the extremes might be compared. This is, in fact, the same as the application of a rule to a case. परामर्श is, however, only a part of the wider process known as अनुमान, which cannot therefore be translated by 'Inference' in the *above sense*. परामर्श, based on व्याप्तिविशिष्टपक्षधर्मताज्ञान corresponds to Aristotle's *Dictum de omni et nullo*.

FIGURES AND MOODS.

The Hindu Dialectic does not work out these distinctions to the full, although it could have easily worked out all the possible figures and moods. But, as we have observed, neither Gautama nor Kanâda proposed to formulate a strictly Formal Logic. The distinction of Figure is not worked out at all. Of Moods, the Hindu Logic mentions only two *viz.*, (1) in which the conclusion as well as the minor premiss are अन्वयव्यतिरेकव्याप्ति i.e. universal affirmatives, (2) in which they are केवलव्यतिरेकव्याप्ति i.e., universal negatives. The major premiss must always be अन्वयव्यतिरेकी, since परामर्श refers to this kind of व्याप्ति alone. Thus the two valid moods correspond to *Barbara* and *Camestres* as follows :—

(i) *Barbara.*

हेतु a साव्य

पद a हैत

∴ पक्ष a साध्य

ii) *Camestres.*

हेतु a साथ

पच्च e हेतु

∴ पञ्च e साध्य

हेलाभास FALLACIES.

Fallacies constitute one of the sixteen Topics discussed by Gautama. Their general classes have already been enumerated, and as their discussion pertains to Inductive Logic, we need not consider them here.

~~Pulav koul
Kashmir
Dai ka gal
Srinagar.~~ —————
~~1958~~

MODEL QUESTIONS AND EXERCISES.

1. Define Logic and state what you consider to be its use in education. Discuss whether *language*, *thought* or *objects* are its subject-matter.
2. What practical value may be attributed to Logic (1) in the detection of error, (2) in the discovery of truth ?
3. Discuss the question whether Logic is a science, or an art, or both.
4. What is meant by saying that Logic deals only with the *form* of thought.
5. Discuss the relations of Logic to Psychology, Grammar, and Rhetoric.
6. Discuss the validity of the distinction between Formal and Material Logic, and comment upon other ways of expressing the same or a related distinction.
7. What do you understand by a Law of Thought ? Examine the question whether the Law of Identity is mere tautology.
8. Distinguish between (1) Abstract and Concrete terms, (2) Proper and Singular terms, (3) Negative and Privative terms. What is the ambiguity in such a term as 'not-white' ?
9. Which of the usual divisions of Terms do you consider of fundamental significance in logical theory ?
10. Classify the following terms logically :—
 table, elephant, prince, Calcutta, Emperor, very, reason, husband, wife, garden, town, lawn, freedom, iron, wish.
11. "The doctrine of Terms is really a composite and for the most part extra-logical body of doctrine." Discuss.
12. What is understood by the Denotation and Connotation of Terms ? Have all terms a denotation and a connotation ?
13. Explain : "As the intension of a term is increased, the extension is decreased."
14. Give some account of the Categories and of their place in Logic.
15. How does Kant criticise Aristotle's Categories ?
16. Give some account of the Predicables. How may they be adjusted to modern thought ?
17. Name the Predicables which cover the predicates in the following sentences :—
 - (1) Newton was a great mathematician.
 - (2) Most Africans are uncivilised.
 - (3) The lion is a ferocious animal.
 - (4) He is a republican.
 - (5) She is a member of St. Hilda's Hall.
18. What is a Definition ? Distinguish it from Description.
19. Distinguish between (1) a Complete and an Incomplete definition, and (2) a Nominal and a Real definition.

20. Criticise the following definitions :—

- (1) Architecture is frozen music.
- (2) A candle is a kind of light used before gas was invented.
- (3) A gentleman is a person who has no visible means of subsistence.
- (4) A gentleman is a man of independent means.
- (5) A dog is a domestic animal that barks.
- (6) A citizen is a man who pays taxes.
- (7) Credit is the bond of society.
- (8) Death is the end of life.
- (9) Life is the opposite of death.
- (10) Wages is the price of labour.
- (11) A woman is a creature who cannot reason and who pokes the fire from the top.
- (12) Life is bottled sunshine.
- (13) Love is the union of hearts.
- (14) Virtue is virtuous conduct.
- (15) Peace is the absence of war.
- (16) Man is a laughing animal.
- (17) A point is that which has no magnitude.
- (18) A noun is the name of a person or thing.

21. Why is it that in defining a species the proximate *genus* and *differentia* should be given, but no *proprium* or *accidens* ?

22. Explain the nature of Logical Division. To what chief defects is it liable ? Can they be obviated by the process of Dichotomy ?

23. Criticise the following divisions :—

- (1) Plant into stem, root and branches.
- (2) Books into bound, unbound, philosophical and historical.
- (3) Noun into Proper, Common, Abstract, Material and Collective.
- (4) Religions into true and false.
- (5) Man into civilized, black, and white, layman.
- (6) India into Bengal, Bombay, Madras, Punjab and the United Provinces.
- (7) House into stone, timber, and mortar.
- (8) Perception into sensation and thought.
- (9) Conduct into good, bad and indifferent.
- (10) Triangle into equilateral, isosceles and scalene.

24. Distinguish between Judgment and Proposition. What is meant by (a) the Quality, and (b) the Quantity, of propositions ?

25. Comment on the statements :—

- (1) ' Judgment is a synthesis of two concepts.'
- (2) ' Judgment is an act of division rather than an act of synthesis.' (Father Joyce.)

26. What is the function of the 'copula'? In what different manners has it been treated?

27. State the following propositions in strictly logical form:—

- (1) Few men are happy in this world.
- (2) Only prejudiced people say so.
- (3) No admittance except on business.
- (4) No news is good news.
- (5) Many a flower is born to blush unseen.
- (6) All is not gold that glitters.
- (7) A few of the mangoes are ripe.
- (8) Every mistake is not a proof of ignorance.
- (9) With Time I have no quarrel.
- (10) The more, the merrier.
- (11) Only philosophers can talk on abstruse topics.
- (12) Every why hath a wherefore.
- (13) A stitch in time saves nine.
- (14) Life every man holds dear.
- (15) Not all who applied were successful.
- (16) Visitors to Oxford should have a look at Christ Church and Magdalen College.
- (17) Every bullet does not kill.

28. In what sense, if any, are Universal Categorical judgments hypothetical?

29. What place should be assigned to the Modality of Propositions in a complete system of Logic?

30. Discuss the relation of the Disjunctive Proposition to (a) the Hypothetical, (b) the Categorical.

31. In a Negative Proposition, does the negative particle belong to the copula or to the predicate?

32. State and discuss the different theories as to the import of a Proposition.

33. Examine the doctrine that a Proposition is the expression of relation between two ideas.

34. Give a concise account of any schemes of diagrammatic representation of propositions, and discuss their value.

35. Explain the "Square of Opposition." Why is contradiction the most perfect type of logical opposition?

36. Granting (a) the truth, and (b) the falsity, of the following propositions, what other propositions can be inferred by opposition to be true or false?—

- (1) Knowledge is power.
- (2) Some Italians are dull.
- (3) All women are not vain.
- (4) None but dead languages are worth studying.
- (5) Kalidasa was the author of the *Shakuntala*.
- (6) Hydrogen is the lightest gas.
- (7) Some statesmen are dishonest.

37. Give the Obverse, Converse and Contraposition of the following propositions :—

- (1) Some doctors are not skilful.
- (2) No good men are insincere.
- (3) All crystals are solids.
- (4) No great mathematician is without imagination.
- (5) None but philosophers understand the Vedanta.

38. Show in what way the Conversion of Propositions is affected by the distribution of their terms.

39. What is a Syllogism ? Show that false premisses of a syllogism may furnish a true conclusion. Can a false conclusion be reached through true premisses ?

40. What is the function of the Middle Term in a Syllogism.

41. What different views have been held as to the *Dictum de omni et nullo* ? How does the view taken bear upon the subject of Reduction ?

42. What can be determined respecting a syllogism under each of the following conditions ?

- (1) That only one term is distributed, and that only once ;
- (2) That only one term is distributed, and that twice ;
- (3) That two terms only are distributed, each only once ;
- (4) That two terms only are distributed, each twice.

43. Why cannot an affirmative conclusion be drawn in Fig. 2 ?

44. Should we treat Fig. 4 as an independent Figure, or only as a variety of Fig. 1 ?

45. Give instances of syllogisms in *Barbara*, *Camestres*, *Disamis*, *Fesapo* ; and briefly explain what is implied by those terms.

46. Construct a syllogism in *Disamis* to prove that 'Some taxation is necessary.'

47. Which figure is most convenient (1) for overthrowing an adversary's conclusion ; (2) for establishing a negative conclusion ; (3) for proving a universal truth ?

48. Discuss the worth of the process of Reduction.

49. Construct an argument in (a) *Ferison*, (b) *Bramantip*, and reduce each to Fig. 1.

50. Distinguish between Direct and Indirect Reduction. Reduce syllogisms in *Baroco* and *Bocardo* ostensively.

51. Name the Figures and Mood of the following syllogism, and reduce it :—

No men are birds,
All birds are animals,
∴ Some animals are not men.

52. Construct syllogism to prove that 'No men are free.'

53. Why is it enough to distribute the middle term only once ?

54. Why must there be at least one more term distributed in the premisses than in the conclusion?

55. Why cannot *Baroco* be reduced indirectly to the fourth figure?

56. Fill up the following enthymemes:—

- (1) If I go on swimming, I shall cut my throat; and if I stop swimming, I shall be drowned.
- (2) A newspaper is either truthful or untruthful: Either believe your daily paper or give up taking it.
- (3) Those who ask shan't have; those who don't ask don't want.

57. Give and illustrate the various definitions of the Dilemma.

58. Can there be a Sorites in the second or third figure?

59. Construct a valid Sorites argument with a negative premiss, and prove its validity by expanding it.

60. Explain the terms: Enthymeme, Episyllogism, Epicheirema, Dilemma.

61. Is it possible to apply distinctions of Figure either to Hypothetical or Disjunctive Syllogisms?

62. Give an example of each form of Dilemma, and show how fallacies may occur in this kind of argument.

63. Rebut the following dilemma:—

If I tell the truth I shall offend the people; and if I tell a lie, I shall offend my conscience;
But I must either tell the truth or tell a lie;
∴ Either I shall offend the people or offend my conscience.

64. 'All reasoning is from universals to particulars.' 'All reasoning is from particulars to particulars.' What is the bearing of these two theories on the doctrine of the syllogism?

65. Criticise Mill's theory of the syllogism. Bring out its psychological basis.

66. 'The problem of inference is something of a paradox: for we have not got inference unless the conclusion is (a) in the premisses, (b) outside the premisses.' Examine this statement.

67. Discuss the claim of the syllogism to cover all forms of deductive reasoning.

68. Can an argument *a fortiori* be reduced to the syllogistic form?

69. Determine the character and form of the following arguments:—

- (a) X lies to the south-east of Z, being due south of Y, which is due east of Z.
- (b) A is taller than C, being taller than B.

70. Discuss whether the syllogism is a *petitio principii*.

71. Examine the following statements :—

- (1) "In the very statement of the major proposition, the truth of the conclusion is presupposed."
- (2) "Syllogism always means a movement of thought that uses what is given for the purpose of advancing beyond it."
- (3) "The analytic order of the syllogism thoroughly disposes of the common but superficial objection that the syllogism is a *petitio principii*."
- (4) 'We do not argue from but according to the major premiss of a syllogism.'

72. Enumerate the faults to which a syllogism is liable, giving instances of each.

73. Give a classification of Fallacies.

74. Distinguish between Error, Fallacy and Paralogism.

75. Examine the following arguments, pointing out the fallacy where it occurs :—

- (1) Many languages are difficult to learn ;
Sanskrit is a language ;
. . . Sanskrit is difficult to learn.
- (2) If rain has fallen, the ground is wet ; but rain has not fallen ; therefore the ground is not wet.
- (3) The crime was committed by the criminal ;
The criminal was committed by the magistrate ;
. . . The crime was committed by the magistrate.
- (4) Perfect ignorance is quiet ;
Perfect knowledge is quiet ;
. . . Perfect knowledge is perfect ignorance.
- (5) Words are but wind.
Learning is nothing but words.
. . . Learning is nothing but wind.
- (6) There can be no real distinction between right and wrong, for whatever is, is right, and wrong certainly is.
- (7) Girls speak French, and learn music and painting ;
William speaks French, and learns music and painting ;
. . . William is a girl.
- (8) The public are a parcel of blockheads, and all blockheads are critics, and all critics are spiders, and spiders are a set of reptiles that all the world despises.
- (9) Spare the rod and spoil the child. But Lal's mother beats him every day ; therefore Lal will turn out very good.
- (10) You are not what I am ;
I am a man ;
. . . You are not a man.
- (11) Who is most hungry eats most ;
Who eats least is most hungry ;
. . . Who eats least eats most.

(12) To be wealthy is not to be healthy ; not to be healthy is miserable ; therefore, to be wealthy is to be miserable.

(13) Giving advice is useless. For either you advise a man what he means to do, in which case the advice is superfluous ; or you advise him what he does not mean to do, and the advice is ineffective.

(14) Great men have been derided, and I am derided ; which proves that my theory ought to be adopted. (De Morgan).

(15) Nothing real is irrational ;
 Everything unreal is transitory ;
 ∴ All irrational things are transitory.

(16) If only the ignorant despise knowledge, this man cannot be ignorant, for he praises it.

(17) An indifferent act is not-right ;
 An indifferent act is not-wrong ;
 ∴ Not-wrong is not-right.
 ∴ Right is wrong.

(18) All monkeys have four legs ; this table has four legs therefore, this table is a monkey.

(19) Kalidasa was a Hindu poet ;
 Bhavabhuti was not Kalidasa ;
 ∴ Bhavabhuti was not a Hindu poet.

(20) All crows are black ; this bird is not black ; therefore this bird is not a crow.

(21) Plato is not Socrates ; Socrates is a man ; therefore Plato is not a man.

(22) Slang is metaphor ; metaphor is poetry ; therefore slang is poetry.

(23) Ill-managed business is unprofitable ; Railways are never ill-managed ; therefore all railways are profitable.

(24) No man is infallible ; the Pope is a man ; therefore the Pope is not infallible.

(25) Five and two are seven ; four and three are seven ; therefore five and two are four and three.

(26) A is superior to B ; B is superior to C ; therefore A is superior to C.

(27) Blessed are the poor in spirit, for theirs is the kingdom of heaven.

(28) Some countries are hot ;
 Some countries are cold ;
 ∴ Some cold countries are hot.

(29) Nothing mortal is incorruptible ;
 Man's soul is incorruptible ;
 ∴ Man's soul is immortal.

(30) Every good deed is commendable ;
 Every good deed is a virtuous act ;
 ∴ Every virtuous act is commendable.

(31) Mr. Kiefe O'Kiefe,
 I see by your brief o'brief,
 That you are a thief o'thief.

(32) Snow is white ; white is a colour ; therefore snow is a colour.

(33) Truth always triumphs ; this theory has triumphed ; therefore it is true.

(34) Arsenic is a poison ; physicians prescribe arsenic to their patients ; therefore, they prescribe poison to their patients.

(35) Men of genius are eccentric ;
 Bose is not eccentric ;
 ∴ Bose is not a man of genius.

(36) The ages of the members of this family are over 100 years ;
 The baby is a member of this family ;
 ∴ The baby is over 100 years.

(37) Ironmongers sell penknives ;
 This man has sold a penknife ;
 ∴ This man is an ironmonger.

(38) What is sold in the market is eaten ;
 Raw meat is sold in the market ;
 ∴ Raw meat is eaten.

(39) Every flatterer is courteous ;
 Z is courteous ;
 ∴ Z is a flatterer.

(40) What is subject to law is not free ;
 Man is subject to law ;
 ∴ Man is not free.

76. Describe Aristotle's classification of Fallacies.
 77. Give Bacon's as well as Mill's classification of Fallacies.
 Name any other you know of.

78. Explain and exemplify the following fallacies :—
Accidens, Petilio Principii, Ignoratio Elenchi, Undistributed Middle.

79. Examine the argument :—“ All responsible beings are rational ; responsibility increases with the increase of rationality ; some dogs are more rational than some men ; therefore some dogs are more responsible than some men.”

80. Test the following arguments, pointing out the fallacy :—

- (1) A good temper is a sign either of a good conscience or of a good digestion ; therefore, the conscientious and the healthy will always possess a good temper.
- (2) The laws of nature can never be broken ; social laws are a part of the general system of natural laws ; therefore, social laws cannot be broken.
- (3) You say that there is no rule without an exception. I answer that in that case, what you have just said

must have an exception, and so prove that you have contradicted yourself.

(4) Knowledge gives power ; consequently, since power is desirable, knowledge is desirable.

81. Distinguish between *semi-logical* and *material* fallacies.

82. Discuss the following argument :—
No man should be punished if he is innocent ; this man should not be punished ; therefore he is innocent.

83. Detect the fallacy in :—“Men are sinners ; saints are men ; therefore saints are sinners.”

84. Examine :—Out of evil comes good ; peace is good ; therefore, peace comes out of evil.

85. Examine the following arguments :—
(1) Elementary education, being compulsory, ought to be free.
(2) No one willingly does wrong ; for wrong-doing certainly leads to misery, and no one desires to be miserable.

86. Criticise the arguments :—
(1) Men can reason without a knowledge of Logic ; therefore the study of Logic is useless.
(2) A man eats either because he is hungry or because he is fond of eating ; hence if he eats when he is hungry, he is not fond of eating.

87. What is meant by an *argument a fortiori* ? Give examples.

88. Explain what is meant of the *Logic of Relatives*.

89. Examine the argument :—‘How can you admit that any wise men are unhappy, when you deny that any dishonest men are wise, and also that any honest men are unhappy.’

90. Consider the following :—
Counsel.—There was no written agreement for the sale of this carpet.
Plaintiff.—Well, you don't have a written agreement when you buy a loaf.
Counsel.—You don't cover a floor with a loaf.
Plaintiff.—Neither do you eat a carpet.

EXAMINATION PAPERS.

CALCUTTA UNIVERSITY.

I. A. LOGIC PAPER, 1917.

1. (a) Explain and illustrate the distinction between Immediate and Mediate Knowledge. Has Logic anything to do with Immediate Knowledge?

(b) What do you understand by Formal Logic? Enunciate the Principle of Identity and state its significance.

2. What is a Term? What do you understand by the Denotation and the Connotation of a term? Are Proper names non-connotative? Fully discuss this question, noticing different views and giving your own with reasons to support it.

or

What are the various classes of terms? Explain each of them and give an example of each.

3. (i) Point out the quality and quantity of each of the following propositions:—

(a) Only ignorant persons hold such opinions.

(b) Few persons are proof against temptation.

(c) Phosphorus does not dissolve in water.

(d) Many are the deserving men who are unfortunate.

(ii) What is meant by the conversion and the obversion of a proposition? Has (b) above any converse? Give reasons for your answer. Give the obverse of (a) and (d) above.

4. Give the Predicative and the Denotative views of the Import of Propositions, and illustrate each by an example. What do you think to be the correct view of the Import of Propositions, and why?

or

Explain and illustrate *differentia*, *property* and *accident*. Distinguish between a separable and an inseparable accident.

5. (a) Prove that in the second figure the major premiss must be universal.

(b) Given that the major premiss of a valid syllogism is affirmative, and that the major term is distributed both in premiss and conclusion, while the minor term is undistributed in both; determine the syllogism.

6. What is Reduction? Distinguish between Direct and Indirect Reduction. Reduce the following argument to the first figure both by the Direct and the Indirect Method:—

No stars are planets;

All planets are organic things;

∴ Some organic things are not stars.

or

What do you understand by a prosyllogism, an episyllogism, and an epicheirema? Give an example of each. Distinguish

between an Aristotelian and a Goclenian Sorites, and prove that in the first figure only the first premiss can be particular in the Aristotelian Sorites.

7. Test any *three* of the following arguments:—

- (a) If a man is educated, he does not want to work with his hands; consequently, if education is universal, industry will cease.
- (b) None but the wise are good, and none but the good are happy; therefore none but the wise are happy.
- (c) We have no right to treat heat as a substance, for it may be transformed into something which is certainly not a substance, namely mechanical work.
- (d) Learned men sometimes become mad; but as he is not learned, there is no danger of his sanity.
- (e) Men who live in society are liable to go wrong morally: therefore, to be virtuous one must renounce society.

CALCUTTA UNIVERSITY.

I. A. LOGIC PAPER, 1916.

1. State and explain the fundamental principles of Deductive Logic.

or

Explain and exemplify:—correlative term, singular proposition, division by dichotomy, Synthetical proposition, Overlapping division, specific property.

2. What is meant by the denotation and the connotation of a term? Discuss the law of their correlation. Has every term a denotation and a connotation?

or

Draw the common square of opposition and explain it. How does it differ from Aristotle's square of opposition? What is the advantage of the latter over the former?

3. Only *three* out of the following to be attempted:—

- (a) Prove that O cannot be a premiss in the first or the fourth figure, and that it cannot be the major in the second figure or the minor in the third.
- (b) If the major term of a syllogism be the predicate of the major premiss, what do you know about the minor premiss?
- (c) Test A E E in each figure.
- (d) If the premisses of a syllogism are false, does this make the reasoning false? Illustrate your answer by a concrete example.

4. What are the various kinds of mixed syllogisms? Show that they are reducible to the forms of the pure syllogism.

5. Explain the two kinds of Reduction. Give a concrete example of *Camenes*, and reduce it by both the methods.

6. Classify the fallacies; mention those that arise from the ambiguity of language and give a concrete example.

7. Test any four of the following:—

(a) The revenues of Vitellius were spent on the necessaries of life, for they were spent on meat and drink, and everyone must admit that meat and drink are the necessaries of life.

(b) Haste makes waste, and waste makes want; therefore a man never loses by delay.

(c) Since the virtuous alone are happy, he must be virtuous if he is happy; and he must be happy if he is virtuous.

(d) To allow every man unbounded freedom of speech is advantageous to the state, for it is highly conducive to the interests of the community that each individual should enjoy an unlimited liberty of expressing his sentiments.

(e) When men are pure, laws are useless; when men are corrupt, laws are broken; laws are therefore unnecessary.

(f) What is Protestantism? It is only loyalty to the Sovereign; for, were not the Protestants loyal to Elizabeth in her struggle with Spain.

PUNJAB UNIVERSITY.

INTERMEDIATE LOGIC, 1917.

1. Discuss the significance of the Laws of Identity, Contradiction, and Excluded Middle.

2. Examine the view that the connotation and the denotation of a term vary inversely. Are there any terms whose denotation may increase without any change in connotation, and terms whose connotation may increase without any change in the denotation?

3. "The mediæval notion that logic is the art of thinking and that its province is to dictate to men how they should think had to be given up, for it rested on a false conception of the relation of theory to practice." Examine the statement.

4. What are the different views advanced regarding the Import of Propositions? State, with reasons, the view you think most satisfactory.

5. (a) Examine the following definitions :—

- (1) A poet is an apostle of sweetness and light.
- (2) Necessity is the mother of invention.
- (3) A gentleman is a man who has no visible means of support.

(b) Mention all the immediate inferences which may be drawn from the proposition : "The virtuous alone are wise."

6. Explain the expressions ; division by dichotomy ; illicit process ; enthymeme ; epicheirema ; sorites ; *infima species* ; tree of Porphyry ; dialectics ; predictable.

7. (a) Construct a syllogism in Bokardo and one in Ferison proving the conclusion that "all is not gold that glitters."

(b) If the conclusion of a syllogism be substituted for the major premiss and the resulting premiss yield a legitimate conclusion, determine the figure and mood of the new syllogism.

8. (a) Examine Mill's view that syllogism is not a form of valid reasoning.

(b) What do you understand by "The Logic of Relatives?"

9. Examine the following arguments :—

(a) Aristotle is a word of four syllables ;
Aristotle is acute ;

∴ Acute is a word of four syllables.

(b) To live well is better than to live ; hence not to live is better than to live badly.

(c) Every hen comes from an egg ; every egg comes from a hen ; therefore every egg comes from an egg.

(d) If I am to pass the examination I shall pass it whether I answer correctly or not ; if I am not to pass it, I shall fail whether I answer correctly or not ; therefore it is of no consequence how I answer the question paper.

PUNJAB UNIVERSITY.

INTERMEDIATE LOGIC, 1916 (*Special*).

1. Logic has often been called a regulative science, Why ?

2. What is meant by a Nominal definition, a Real definition, and a Genetic definition ? Give examples.

3. What do you know of Aristotle's List of Categories ? In what regard is it superior to the ordinary classification of Predicables.

4. What are Indefinite, Singular, Modal, Exponible and Hypothetical propositions ? Give illustrations.

5. Examine the logical characteristics of the following :—

(1) I know that I know ; (2) Uneasy lies the head that wears a crown ; (3) Wisdom is better than rubies ; (4) If you fear to fall,

do not climb at all ; (5) Is it beyond thee to be glad with the gladness of the universe ?

6. Examine Welton's scheme of diagrammatic representation of propositions and point out its special features.

7. What are the logical uses of the Second and Third Figures ? Why cannot A be proved in any figure but the first ?

8. State and prove the rules of the Goelenian Sorites.

9. Give examples of the following fallacies :—Fallacy of Accident, Converse Fallacy of Accident ; Ignoratio Elenchi ; Petitio Principii.

PUNJAB UNIVERSITY.

INTERMEDIATE LOGIC, 1916.

1. Distinguish between Logic and Psychology, and between Logic and Grammar.

2. What is Contraposition ? Give three examples.

3. Explain with examples the *Dictum de omni et nullo*.

6. Give the special rules of two figures of the syllogism. Show by examples the result of breaking the rules you give.

7. Give three actual and three symbolical examples of Direct Reduction.

8. Deductive Logic has been described as the Logic of Consistency. Explain and illustrate this.

PUNJAB UNIVERSITY.

INTERMEDIATE LOGIC, 1915 (Special).

1. What is the relation between Connotation and Denotation ?

2. What is an Immediate Inference ?

3. Explain, with *examples of your own*, the Fallacy of the Undistributed Middle.

4. Discuss the value of the Laws of Thought.

5. Illustrate, with *examples of your own*, the Principles of Definition.

6. Give the table of the kinds of syllogisms with an example of each kind *made up by yourself*.

7. (a) Criticise :—

(1) Every dog is a quadruped ;

No cat is a dog ;

∴ No cat is a quadruped.

(2) Nouns are divided into Proper, Common, Collective and Abstract Nouns.

(3) A noun is a name of a person or thing.

(4) A worm cannot be an animal, because all animals are vertebrates, and worms are not vertebrates.

(b) Give examples of (1) *Hysteron proteron* ; (2) *Fallacia Consequentis* ; (3) Simple Destructive Dilemma.

ALLAHABAD UNIVERSITY.

INTERMEDIATE LOGIC PAPER.

1. (a) Distinguish between the form and matter of thought ; also between formal and real truth.
 (b) Is Deductive Logic a formal science ? Give reasons for your answer.
2. (a) What is meant by the denotation and connotation of a term ?
 (b) Explain and illustrate the rule, that as the denotation of a term decreases its connotation increases.
3. (a) State the rules of Logical Division.
 (b) Examine the following divisions :—
 1. The world into Asia, Africa, and Europe.
 2. Books into entertaining and unentertaining.
 3. Men into those who lend and those who borrow.
 4. Religion into Christian, Mahomedan, Hindu and Parsi.
4. Determine the quantity and quality of the following propositions :—
 - (1) Men usually rise or fall to the level of their reputation.
 - (2) Of all the forms of government, democracy is by far the most difficult.
 - (3) If a University gives stimulative teaching, it does everything ; if it fails to do this, it does nothing.
 - (4) There never was a sea-serpent.
5. (a) Define Dichotomy, Dilemma, Obversion, Contraposition, Opposition, and Sorites.
 (b) Draw two valid immediate inferences from each of the following propositions, giving the technical names of the processes employed :—
 - (1) No created being is perfect.
 - (2) Some substances have no cause.
6. (a) Explain the nature and use of Reduction.
 (b) Take any two moods in the Fourth Figure, and reduce one of them by the direct and the other by the indirect method.
7. Examine the following arguments :—
 - (1) If Cæsar was a tyrant, he deserved to die ;
 Cæsar was not a tyrant ;
 ∴ He did not deserve to die.
 - (2) I cannot accept your opinion as true, for it seems to me that its general recognition would be attended with the most injurious consequences to society.
 - (3) Opium produces sleep, for it possesses a soporific virtue.
 - (4) All who think this man innocent, think he should not be punished ; you think he should not be punished ; therefore you think him innocent.

ALLAHABAD UNIVERSITY.

INTERMEDIATE LOGIC PAPER.

1. What is in your opinion the educational value of the study of Deductive Logic.

2. Show by examples that the division of terms into general and singular does not coincide with the division into abstract and concrete. Distinguish between general and collective terms.

3. What is meant by logical definition ? Define any three of the following :—

History, Cricket, Geometry, *Hundi*.

4. What is meant by the quantity and quality of a proposition ? State the quantity and quality of the following, in each case giving reasons for your answer :—

(1) Roses grow in Persia.

(2) Wealth is not the highest good.

(3) Certain Greek Philosophers were the founders of Logic.

(4) Few men know how little they know.

5. Explain what is meant by the conversion of a proposition. Of what practical value is conversion ? Convert the following :

(1) All graduates are not wise.

(2) All dogs can bite.

(3) Terriers are a kind of dog.

6. Prove the following syllogistic rules :—

(1) In the First Figure the minor premiss must be affirmative.

(2) In the Second Figure the conclusion must be negative.

(3) In the Third Figure the conclusion must be particular.

7. Give, avoiding the use of mere letters, an instance of a Destructive Hypothetical Syllogism. By what rule is the validity of hypothetical syllogisms tested ? To what fallacies associated with categorical syllogisms would the violation of this rule correspond ? Illustrate your answer by the syllogism already given.

8. Examine any four of the following arguments :—

(1) Wisdom dwells with age, we should therefore in all matters abide by the customs of our ancestors.

(2) This poem cannot be the work of Tennyson, for it differs both in style and subject-matter from such poems of his as I have so far read.

(3) Six manuscripts have this reading, while two only have that found in your copy of the book. There is no doubt, therefore, that the former reading is to be preferred.

(4) The writer is a historian of great learning, and if he denies the existence of God, what wise man will dissent from his opinion?

(5) The percentage of success in the Entrance is higher than in the Intermediate Examination; it is obvious from this that the teaching in school is superior to that in colleges.

BOMBAY UNIVERSITY.

INTERMEDIATE LOGIC PAPER.

1. Discuss the relation of Logic to Psychology and to Language. Distinguish between a judgment and a proposition.

2. (a) Distinguish Abstract terms from Attributives and from Concrete terms.

(b) Explain:—"Singular terms are only mediately connotative."

(c) To what class do the terms constituting the following propositions belong:—

(1) Quickly is an adverb.

(2) The man of whom I was speaking this morning is as good as gold.

(3) These books can fill a large box.

(4) Arguing with a prejudiced person is like flogging a dead horse.

3. (a) Explain with the aid of illustrations:—"All negative propositions distribute their predicate, whereas affirmative propositions do not." Are there any exceptions to this rule?

(b) State the following in Logical form and give their quantity and quality:—

(1) All those who preach social service are not self-sacrificing.

(2) All your anxiety will not save him.

(3) There are many rich people in Bombay.

(4) They never pass their examination who are both dull and lazy.

4. (a) Show that all particular propositions must be *real*.

(b) State whether the following propositions are verbal or real, and refer their predicates to the Heads of Predicables to which they belong:—

(1) A dog has four legs and one tail.

(2) A triangle has three angles.

(3) The men behaved foolishly.

(4) A noun is the name of a thing.

(5) Socrates was a philosopher.

5. (a) What is meant by Contradictory Opposition ? Explain why it is the only form of Opposition that can subsist between Singular Propositions.

(b) Assuming that the following statement is incorrect, what propositions can be asserted as true :—

“ Poets alone are men of genius.”

(c) Criticise the following inferences, explaining the logical processes where they are correct, and pointing out the exact mistake where they are wrong :—

(1) Every poison can destroy life;

∴ Everything that cannot destroy life is non-poisonous.

(2) Every teacher has been a student ;

∴ Every student has been a teacher.

(3) No unlucky person attains success in life ; therefore, no person who has not been successful in life, is lucky.

6. Assuming that the following are valid arguments, give their full logical expression :—

He will certainly not punish you, for he never fulfils his threats.

Only a clever man could succeed here, and he is not clever.

There must be a ship in sight, for the flag has been hoisted.

7. “ In the First Figure the minor premiss must be affirmative ” Prove this by the aid of a diagram or otherwise.

8. (a) State the following in a disjunctive syllogism :—

It is hot here to-day, for unless there is a wind it is always hot here, and there is no wind to-day.

(b) Express the following argument in the form of a dilemma, and rebut it :—

In accepting a post under his control you are bound to have to endure some disadvantage, for in the hills the life is arduous, and in the plains the climate is trying.

10. Name the fallacies, if any, in the following arguments, explaining succinctly how they arise :—

(a) A pack of wolves can easily kill a sambhar, therefore a wolf is a more formidable animal than a sambhar.

(b) You are fond of oranges, therefore this orange, though sour, will please you.

(c) All men who endure torture for the sake of their country must be men of high courage, Regulus, the Roman Consul, endured torture for the sake of Rome ; therefore, he must have been a man of high courage.

(d) You are wise, for you paid attention to the advice of your superiors, and wise men always do so.

MADRAS UNIVERSITY.

INTERMEDIATE LOGIC PAPER.

1. What is the distinction between a Normal and a Natural science ? Explain, using the relation between Psychology and Logic as an illustration.

2. (a) Write brief notes on (i) General and Singular names and ; (ii) Concrete and Abstract terms.

(b) Consider the logical characteristics of the following when employed as terms in a judgment :—(i) Colour ; (ii) This paper ; (iii) Washington ; (iv) The first President of the United States ; (v) Aristocracy ; (vi) Common Salt.

3. State the rules of Division.

4. (a) Express the following statements in one or more of the categorical propositional forms recognised in Logic :—

(i) No one can be a successful leader of a social reform movement unless he is exceptionally courageous.

(ii) It is not true to say that only the courageous are successful, nor that the successful alone have been courageous.

(b) Give the contradictories of :—

(i) None but the truthful are virtuous.

(ii) Some but not all men are truthful.

(iii) If one is truthful, then one is virtuous.

5. (a) Elucidate the opposition between the following propositions :—

(i) Only the faithful are happy.

(ii) Not a few of the faithful are happy.

(iii) Nobody can hold that those who are happy are all faithful.

(iv) Indeed, no people who are happy are at all faithful.

(b) Give the Obverse, Contrapositive and Inverse :—

(i) No patriot could even be without honour in his own country.

(ii) Excepting those who are unselfish and brave, none could be a real patriot.

6. What is the relation between Hypothetical and Categorical propositions ?

7 (a) Solve the following problems by a *direct* application of the rules of the syllogism, i.e., without reference to particular Figures and Moods :—

- (i) Construct all the possible syllogisms in which 'Some S is not P' is a valid conclusion.
- (ii) Given that the minor premiss is negative, determine the different valid syllogisms.
- (iii) What are the valid syllogisms in which two terms are distributed, each twice ?

(b) Put the following argument in syllogistic form, and express it in as many moods of Fig. 3 as possible, using for this purpose any processes of Immediate Inference you deem necessary :—

'It is not true that no rational beings are mortal, seeing that all men are mortal :

(c) Test the Formal validity of the following arguments :—

- (i) Moral and religious instruction can be of no use whatever, since we know from an experience of men that a great many, nay, probably the majority, of rogues have a considerable knowledge of religion and morals.
- (ii) If all educated men were true to their ideals, the country would have been very prosperous ; but it is not prosperous ; therefore it is certain that none of the educated are true to their ideals.

MADRAS UNIVERSITY.

B. A. LOGIC PAPER (1913).

1. 'Logic is the science of the Forms which knowledge of reality exhibits as it develops in the individual mind.' Explain this definition.

2. 'What is true in one form of words is true in every other form of words which conveys the same meaning.' Discuss this as an account of the Law of Identity.

3. Estimate the value of the common statement that the genus is characterised by a smaller number of attributes than any of its subordinate species.

Is it strictly correct to speak of the Inseparable Accident of a species ?

4. Two classes of judgments have been distinguished by logicians, the Synthetical and the Analytical. Criticise the distinction and show that the same judgment is both synthetical and analytical.

5 Regarding the question whether Immediate Inference is inference properly so called, a modern logician says:—

‘In real reasoning even the most trivial of immediate inferences involves a risk and may need scrutiny, nor does it ever “follow of necessity.” If its assertor denies that he has asserted anything new, he is met by the retort, “Why then, did you assert it ?”; if he admits it, he admits also that the value of the novelty may be inquired into.’

Do you admit the above contention ? If not, give your own view, with reasons.

6. Deduce from each of the following all the immediate inferences, both by way of Opposition and by way of Eduction :—

- (a) Not to all men it is given to be poets.
- (b) Only true piety will lead to communion with the Deity.

7. (a) Prove that if a valid syllogism contains O as premiss, its middle term must occupy the same position in both premisses.

(b) Construct a syllogism in *Felapton* to prove that ‘Some logicians are not good reasoners.’

(c) Take a concrete example in *Bokardo*, and reduce it directly.

8. Throw the following into syllogistic form, and point out the fallacy, if invalid :—

(a) Our knowledge that this is water is true knowledge, because it induces activity which results in the satisfaction of our thirst. Whatever is not true does not induce successful activity.

(b) Srinivasan loves to hear a good story told about his own moral courage, as he is a man, and all men love to hear good stories.

9. Analyse the following passage into its component arguments :—

If I were myself the author of my being, I should have bestowed on myself every perfection of which I possess the idea, and this cannot be considered more difficult than the primary act of which I am deemed capable, *viz.*, that of creating myself, a thinking being, out of nothing.

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